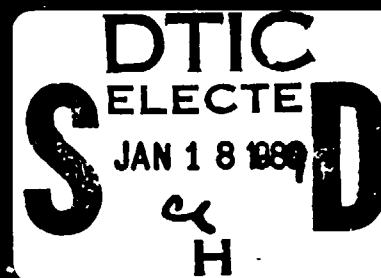


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BOLSTERING DEFENSE INDUSTRIAL COMPETITIVENESS

**PRESERVING OUR HERITAGE
THE INDUSTRIAL BASE
SECURING OUR FUTURE**



**Report to the Secretary of Defense
by the
Under Secretary of Defense
(Acquisition)**

July 1988

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THE UNDER SECRETARY OF DEFENSE

WASHINGTON, DC 20301

ACQUISITION

July 15, 1988

TO THE SECRETARY OF DEFENSE:

Enclosed are the results of our examination of the problems facing the United States defense manufacturing base. Our objective was to identify the actions necessary to prepare the Department better to deal with the dynamics of manufacturing worldwide. The recommendations we are already putting into action center around six major thrusts: forging the right relations with industry; improving the acquisition system; establishing defense industrial strategic plans that support our military strategic plans; developing manufacturing capabilities concurrent with development of weapon systems; laying the foundation now for the technical skill base required for tomorrow's defense needs; and ensuring that industrial base issues important to our defense benefit from the full spectrum of potential policy remedies, when appropriate.

An underlying message of this project, which is based on extensive advice from industry, academia, and other Government agencies, is that cooperation is an essential foundation to meeting and sustaining defense goals. Our cooperation with industry, with our allies, with other agencies, and with the Congress is imperative if we are to meet ever more sophisticated requirements with relatively fewer resources. Through this project, we are taking the first steps toward such cooperative relationships. Achieving these relationships, however, is requiring a culture change throughout the Department. Our challenge, as you have stated on many occasions, is to maintain serious and consistent efforts toward this goal. I am committed, as I know you are, to make this contribution.

Attention on the defense industrial base has focused on its problems, many of which have been characterized as insurmountable. While we certainly would not claim to have proposed solutions to all these problems, this project has shown, once again, that the nation is willing to assist the Department. We were most fortunate to have the assistance of a talented and dedicated staff, as well as hundreds of individuals, from Nobel laureates and chief executive officers to production line engineers, who generously gave of their time and ideas. The nation's great untapped resources of commitment and ingenuity are our best promise that the security of future generations can be assured.

A handwritten signature, likely of the Under Secretary of Defense, is located at the bottom right of the page. The signature is written in dark ink and is stylized, with the first letters of the first and last names being prominent.

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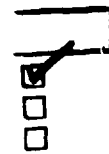


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FOREWORD

By Dr. Robert B. Costello

Under Secretary of Defense (Acquisition)

A competitive industrial base is key to deterring aggression and, should that fail, to winning wars. The direct role of our industrial base in waging war successfully has been demonstrated during all major conflicts. Thus, the real thrust of this report is to define Department of Defense options to ensure a strong industrial base that will enable us to react appropriately and successfully to any threat.

The North American industrial base provides the weapon systems (from rifles to aircraft and ships) and the major components (for example, radars and engines) needed by our armed forces. It also provides the important logistics support (including food, fuel, spare parts, clothing, ammunition, medical supplies, etc.) required in wartime or peacetime to sustain operations. Our ability as a nation and a continent to supply this materiel to our armed forces is critical and is the reason why it was necessary to frame the action plan that is the central theme of this report.

Defining the breadth of our industrial base is complicated; we rely on a global market that produces both civilian goods and military materiel. Additionally, our industrial base represents not only the capacity and capability to produce goods at an appropriate rate, but the technology upon which these goods are predicated. Add to this economic and efficiency considerations and it becomes apparent that our industrial base is a highly interdependent and extremely complex structure.

As a customer of the industrial base, the Department's peacetime requirements generally are a small fraction of an industry's capacity. Concomitantly, combat requirements are significantly larger and must be satisfied. By itself, the Department of Defense is incapable of sustaining the industrial base upon which it depends. American industry must, of its own volition, remain commercially competitive in today's world economy. The Department, however, can participate in or lead activities that bolster American industrial competitiveness in world markets while ensuring industry's ability to assume a direct role in supporting our combat requirements.

The Department of Defense initiated this effort in June 1987. During this period, the Department obtained information on bolstering industrial competitiveness from more

than 300 Government policymakers, industry leaders, academicians, and representatives of professional societies and industry associations.

Our study, which addresses old issues from a new perspective, was designed to reach a broad consensus on Department of Defense actions that would make a difference in supporting combat operations. We did not attempt to identify industries in need of Government assistance nor to prescribe formulae for their resurrection. Nor did we elaborate any cookbook solutions; but rather we attempted to demonstrate that there is a role for the Department of Defense, and there are processes for defining, by industrial segment, what might be done.

The project itself is an example of the Department's efforts to forge the right relations with industry and to explore how we can bolster industrial competitiveness to benefit the Department of Defense and to ensure America's pre-eminence in tomorrow's world economy.

SUMMARY
REPORT TO THE SECRETARY OF DEFENSE

SUMMARY

The defense industrial base generally comprises the same manufacturers that produce goods for the general public. Few industries rely primarily or completely on the Department of Defense as their principal market. However, the Department depends on virtually every sector of the manufacturing base for materiel. Ninety-five percent of the manufactured goods purchased by the Department of Defense come from a broad spectrum of 215 industries. In 1985 the Department spent almost \$165 billion within these industries. This represented 4.1 percent of America's total gross national product and 21 per cent of the manufacturing gross national product. However, while the Department of Defense is a major purchaser of manufactured goods, we recognize that in many important sectors, such as electronics, we purchase only a small portion of total output. Even so, our market share (even in the electronics industry) can provide us with substantial leverage if properly managed.

In addition to meeting requirements for the production of today's weapon systems, the Department's investment in the industrial base must encourage the research and development for advanced technologies that are key to the next generation of weapon systems. These include technologies such as infrared focal plane arrays, microwave devices, advanced sensors, exotic alloys requiring powdered metallurgy technology, high temperature ceramic composites, and high temperature superconductors. Additionally, advanced manufacturing strategies, such as flexible computer-integrated manufacturing, must be developed for and integrated into the entire industrial base.

As a nation and as a continent, we no longer are totally self-sufficient in all essential materials or industries required to maintain a strong national defense. Consequently, we must identify requirements carefully and assess them against our industrial base capabilities. We must develop strategies that enable us to meet security needs with available resources. For those essential products the United States does not manufacture, we must rely on offshore sources or stockpiles. We can, however, offer incentives to establish domestic manufacturing industries for these products.

Clearly, the Department of Defense cannot provide massive financial assistance for every American industry characterized by a lack of international competitiveness, nor can we effectively provide incentives for every manufacturing industry critical to our defense. The

issue of competitiveness is one that requires continuing creativity and innovation within the private sector. There are numerous factors that industries themselves must come to grips with if they are to remain competitive in the international market place. There are also national issues, such as our tax code and antitrust laws, that warrant our attention. Our education system has been cited as providing a less than adequate technically trained labor force for the future. To the extent that these and other national issues affect the industrial base, the Department of Defense intends to stimulate, when warranted, appropriate activities throughout the Government to address them.

Within the Department of Defense acquisition process we have identified several areas that are impediments to efficient defense production. Frequent policy changes, emerging technologies, changing military requirements, the defense budgeting process, and program and budget instability make long-term planning difficult. Typically, small volume purchases and program *stretch-outs* contribute to an environment in which defense contractors have little incentive to make long-term investments in facilities with advanced capabilities that could yield higher quality and more competitive products.

Commercial market rewards for performance are lacking in the defense market. Unit cost reductions, quality improvement, shortened delivery times, etc., neither stimulate demand for additional units nor provide greater market share; nor do unit cost reductions result in increased profit. Emphasis on lowest bid cost may result in inadequate attention to life cycle costs, quality, and past performance.

The Department of Defense reliance upon detailed product and process specifications can be counterproductive. Outdated specifications frequently reduce innovation, inhibit improvements, and result in excessive administrative processes required to implement, monitor, waive, or modify specifications. Procurement processes focus mainly on prime contractors, even though materials and components purchased by prime contractors from lower-tier industries represent 50 to 85 percent of our total expenditures. Historically, the Department has had limited direct influence on the performance of subtier contractors because of considerable administrative difficulty in passing performance incentives through prime contractors to multiple levels of subcontractors and suppliers.

Finally, layers of bureaucracy and somewhat cumbersome contract administration processes add to the costs of doing business with the Department of Defense.

Government emphasis on oversight activities can lead business managers to focus more on meeting inspection requirements than on improving quality and productivity.

This Department of Defense report is designed to provide both a strategy and specific initiatives to address this concern. Integral to this strategy is a recognition that the Department's influence is, at the same time, significant and limited. The strategy suggests exploiting the Department's leadership and leverage potential to strengthen the industrial base, but not to the exclusion of other Departmental priorities such as a well equipped force structure. On the other hand, it is neither possible nor desirable for the Department to solve all the ills of the commercial manufacturing sector.

The cornerstone of this effort is cooperation with domestic industry and our allies. The United States could not build fortress America, even if this were a desirable objective. Nor can the Department of Defense reverse worldwide economic trends, such as the internationalization of manufacturing. To maximize domestic industry's potential, cooperative relationships must flourish among the Department of Defense, large corporations, and the lower-tier manufacturing industries that are the foundation of our industrial base.

Embedded in this action plan are six strategic thrusts: (1) forging the right relations with industry; (2) improving the acquisition system; (3) establishing defense industrial strategic plans that support our military strategic plans; (4) developing manufacturing capabilities concurrent with the development of weapon systems; (5) laying the foundation now for the technical skill base required for tomorrow's defense needs; and (6) ensuring that industrial base issues important to our defense benefit from the full spectrum of potential policy remedies, when appropriate. These recommendations were framed to address the fundamental causes of our industrial competitiveness problems, but we did not attempt to address all the symptoms. The recommendations reflect the complex and long-term nature of the problem and the need for the Department of Defense to establish the institutional mechanisms for a consistent and sustained approach in developing solutions.

We are working also on the shorter term solutions. Based on the findings and recommendations in this report, which were developed over the past year, we already have taken three broad, positive actions to affect our acquisition management process and to increase the Department's emphasis on production and manufacturing.

Considerable progress already has been made on the first of these, the newly established Defense Manufacturing Board. The Defense Manufacturing Board is modeled after the highly successful Defense Science Board. This organization is managed internally by the Department, with Board members appointed from industry, labor, and academia. It has the capability to analyze manufacturing issues salient to the Department and to explore manufacturing problems in classified programs. The Board is an advisory body, responsible to the Under Secretary of Defense (Acquisition), for policies on research, development and acquisition as they pertain to improving quality and manufacturing effectiveness in prime and subtier suppliers.

Secondly, the Manufacturing Strategy Committee is being established by the National Academy of Sciences to provide a parallel non-defense counterpart organization to the Defense Manufacturing Board. The members of this body will come largely from non-defense manufacturing companies and will provide the Under Secretary of Defense (Acquisition) policy advice on long-range manufacturing issues from much broader international and domestic perspectives.

Finally, the Department is establishing a Production Base Advocate as the focal point for manufacturing systems issues. Issues will range from the integration of manufacturing considerations into research and development and engineering policy, to the exploitation of innovative production and acquisition concepts in pilot programs. Industry repeatedly has expressed frustration with the Department's lack of responsiveness to suggestions for improvement. The Production Base Advocate now will provide industry with one focal point responsible for evaluating and acting upon industry's suggestions or complaints. The Production Base Advocate will have authority to experiment with new ideas and to suggest policy changes arising from such experiments. The office of the Production Base Advocate will be more than a coordinating office; it will be a center for innovation.

Perhaps the greatest challenge lies in developing innovative solutions to industrial base shortfalls. With the likelihood of little or no growth in defense budgets, increased funding on a broad front is not a practical approach to bolstering industrial competitiveness. Keys to finding innovative solutions include cooperating with industry and foreign nations; exploiting the Department's leadership role; stimulating private-sector initiatives in lieu of Government-dominated solutions; creating an attractive environment to enable private

sector ingenuity to flourish; and developing within the Department better means for anticipating problems and responding in a timely fashion.

The research for this report has provided a baseline for establishing means to evaluate criteria to define and prioritize the criticality of domestic products or capabilities. In assessing industrial base capability, traditional as well as global industrial resources available to the Department must be explored. Rather than create new data bases, the Department will develop the means quickly to access available data. Two existing Department of Defense initiatives in this field are the Defense Industrial Network and Project SOCRATES. The Defense Industrial Network monitors the capabilities of subtier and basic industries essential to defense production, drawing upon a large number of existing data bases. Project SOCRATES examines technology availability on a global basis. An evaluation is underway to consider the feasibility of consolidating both systems, combining their domestic industrial and global technology information into one comprehensive system. The Department also is exploring the possibility of utilizing the U.S. Census Bureau as a primary data collection source. These initiatives will minimize duplication, foster consistency, and provide currently unavailable essential data for comprehensive defense industrial analysis.

Many studies have been performed and much has been written about the deficiencies in the United States educational system. These shortcomings allegedly contribute to American manufacturers' lack of competitiveness. Focusing on manufacturing, there are inadequacies in our educational system that should be addressed. Regrettably, American industry has aggravated the problem by failing to emphasize manufacturing. There are numerous activities the Department of Defense will pursue that can make a positive contribution to enhance our individual and corporate manufacturing expertise.

We will tap the substantial education and training resources of the Department by concentrating our resources on building manufacturing management and systems expertise. We can have a significant impact on the current and the next generation of technically trained people. For example, the Military Departments sponsor large numbers of training courses and educational programs for both military and civilian personnel of the Department of Defense. We intend to request the Secretaries of the Military Departments to review their existing education and training programs and provide recommendations on utilizing education and training resources to improve the understanding and management of manufacturing functions.

The Department of Defense will encourage building university expertise in manufacturing by combining a scholarship program in manufacturing with industry and university efforts to build regional knowledge centers. As envisioned, the Department might offer scholarships at universities willing to build world class manufacturing management and technology programs. The schools would be selected based upon a commitment to maintain leading edge university expertise; industry support for endowing faculty positions to enable the world's best manufacturing managers to teach future generations; a commitment from industry to establish hiring programs to assure that the finest career opportunities are afforded to the new generation manufacturing manager; and a state and university commitment for faculty and curriculum development to stay on the leading edge of technological progress. This program should have a minimum commitment of five years from the Department of Defense, but must be matched by industry and participating universities.

Our security, while the explicit responsibility of the Department of Defense, is the implicit responsibility of the entire Federal Government and all the citizens of this nation. The Department has a mandate to ensure the existence of a viable industrial sector to meet defense requirements, both for leading edge technology and production capacity. But, this responsibility does not end with the resources of the Department of Defense. It is incumbent upon the Department to explore all potential solutions. Stated simply, the Department of Defense intends to seek the assistance of other Federal agencies to bolster industrial competitiveness when it impacts our security.

From now on, the Department regularly will seek the advice and assistance of the domestic and economic policymaking organizations of the Executive Branch to find the most cost effective solutions to defense industrial base deficiencies identified by the Department. Indeed, requests for advice and assistance were initiated during the extensive consultations with other departments and agencies which occurred in the effort leading to this report.

Preliminary discussions further exploring this approach have been held with both the Treasury Department and the Cabinet level Economic Policy Council. Both organizations support this concept and believe that more effective approaches utilizing broader policy perspectives should be implemented. This approach potentially could bring to bear the full weight of tax, trade, antitrust and other Government policies in supporting the security missions of this Department.

Brief synopses of the recommendations, together with comments on their current status, are presented in the remainder of this summary.

SYNOPSIS OF RECOMMENDATIONS AND PROGRESS

- ***Forging the Right Relations With Industry: Establish a Defense Manufacturing Board (similar to the Defense Science Board) and a Manufacturing Advisory Council (sponsored by an objective third party) to address defense manufacturing issues and problems.*** The Defense Manufacturing Board has been established and the National Academy of Sciences is forming the Defense Manufacturing Strategy Committee.
- ***Strategic Planning Task Force: Establish a task force to determine the best means to provide industrial support for military operational plans and determine which ones should be supported by industrial strategic planning.*** Once convened, it will report to the Deputy Under Secretary of Defense (Production Base and International Technology).
- ***Production Base Advocate: Establish an organizational focal point to receive, evaluate, and test innovative ideas to improve Department of Defense manufacturing programs.*** The Production Base Advocate's office will be established as the Office of the Deputy Under Secretary of Defense (Production Base and International Technology).
- ***Analytic Capability to Develop Defense Perspectives: Establish permanent, institutional mechanisms to acquire, analyze, and assess manufacturing and technology data.*** The Defense Industrial Network (which provides manufacturing data) and Project SOCRATES (which provides technology data) will be merged into a natural language, expert system within one organization, the Defense Industrial Base Information Administration, which will report to the Deputy Under Secretary of Defense (Production Base and International Technology).
- ***Foreign Dependencies: Develop and implement systems to provide visibility of critical foreign-sourced items in or proposed to be in new weapon systems, prior to the demonstration/validation decision milestone during the acquisition decision-making process.*** The Deputy Under Secretary of Defense (Production Base and International Technology) will be responsible for assessing foreign dependencies within the appropriate Defense Acquisition Board committees and for reporting the findings to the full Defense Acquisition Board.

- **Factory Modernization Investments:** *Determine the appropriate incentives for productivity enhancing investment by defense contractors and create an environment more conducive to the successful administration of the Industrial Modernization Incentives Program.* This is the first of several recommendations that will be submitted to the Defense Manufacturing Board and/or the Defense Manufacturing Strategy Committee so a methodology can be developed to achieve this objective.
- **Program Stability:** *Achieve greater stability in major acquisition programs through the use of two-year budget cycles, multi-year contracts, and a more realistic (achievable) five-year program.* This task will be further explored by the Defense Manufacturing Board and/or the Defense Manufacturing Strategy Committee.
- **Life Cycle Costs:** *Raise the priority of using life cycle costs as a basic evaluation technique in acquisition programs.* This has been implemented in the Defense Acquisition Board. The life cycle cost of a weapon system is now considered at every Defense Acquisition Board decision milestone and during the planning, programming and budgeting system process.
- **Quality Control:** *Develop an effective "quality first" program.* The Department has underway its Total Quality Management program with the objective of reducing weapon systems' costs while improving their quality in the field.
- **Commercial Specifications and Processes:** *Increase the use of commercial manufacturing process and product specifications in lieu of unique military specifications.* The Department's Defense Standardization Study Team recently concluded its activities and made twelve recommendations we are implementing, including: eliminating military specifications for commercial products, using multiple award schedules, reviewing all government specifications, converting specifications to living documents, and automating data bases. Additionally, the Defense Manufacturing Board and/or the Defense Manufacturing Strategy Committee will address how integrated manufacturing of commercial and military products can be achieved.
- **Emphasis on Process Technology:** *Provide greater emphasis on the development and application of process technologies.* The Defense Advanced Research Projects Agency has established the Defense Manufacturing Office to administer the Defense Manufacturing Initiative for developing manufacturing process technology that will help assure the Department of a domestic supply of affordable electronic, computer, and software components for rapid insertion into weapon systems.

- ***Technological Skill Base/Incentives for Technical Education/Educational Facilities/Education and Training:*** Increase the numbers of technically trained college graduates, doing it partially through scholarship programs sponsored by the Department of Defense; provide seed money for better educational facilities; and enhance education and training. The Deputy Under Secretary of Defense (Production Base and International Technology) will convene a task force from academia, industry, and Government to recommend Departmental courses of action.
- ***Production Base Impact Assessment:*** Establish a substantial analytic capability within the Legislative Branch dedicated exclusively to objective analysis of the impact of existing and proposed legislation on the United States manufacturing base and its ability to compete internationally.
- ***Coherent Tax Policies/Coherent Trade and Domestic Policies:*** The appropriate agencies conduct a comprehensive analysis of tax, trade, and domestic policies specifically focused on enhancing the international competitiveness of American manufacturing industries.
- ***Private Sector Issues:*** Identify and eliminate Government barriers to management motivation to achieve manufacturing excellence and competitiveness. To this end, the Department has increased progress payments, restricted the use of fixed price research and development contracts, and has more clearly defined the role of the program manager vis-a-vis contracting officers and auditors.

REPORT TO THE SECRETARY OF DEFENSE

CHAPTER I

OVERVIEW

There is a growing perception among American citizens that America's industrial base is on a downhill course to second-class status. Despite general economic prosperity, there is concern over America's ability to compete in the international marketplace. The Department of Defense also is becoming increasingly concerned. Many basic industries of importance to defense production have declined, threatening the responsiveness of our industrial base. Left unchecked, such erosion could rob the United States of industrial capabilities critical to national security. An efficient, responsive, and technically innovative industrial base is necessary to develop and produce high-quality, affordable defense systems and to maintain our ability to deter aggression or defeat potential adversaries.

In early 1987, the Department of Defense Strategy for Bolstering Defense Industrial Competitiveness was launched. This report represents the culmination of the first phase of that effort.

This report is not based upon an examination of the universe of American manufacturing industries, and does not attempt to make the case that all American manufacturing industries are in decline. In fact, for many years manufacturing has remained fairly constant as a percentage of the United States gross national product, indicating, generally, that the American manufacturing base remains healthy and productive.

Major sectors of American industry are vital and highly competitive in both domestic and international markets. Within other sectors that have not yet been subjected to intense import pressures, there are many firms that continue to compete in the domestic market and some that are effective competitors in international markets. Even in industries subjected to intense competition from foreign firms, some American firms have been or recently have become fiercely competitive.

There are, nevertheless, serious indications of decline in sectors of the industrial base that are fundamentally important to national security and to continued American leadership in advanced technologies. From one sector to another, the indications are somewhat irregular, but, from the defense perspective, the issue is too important to ignore and too vital to presume there is no problem.

Particularly devastating in the long-term is the loss of key production technologies and equipment. In some vitally important technologies, such as machine tools and electronics manufacturing equipment, the erosion has been particularly severe. These are but the leading edge of scores of technologies in which other nations are developing the most advanced manufacturing technologies for the most advanced products. Such loss of supremacy in manufacturing technologies is a particularly insidious threat to American technological and manufacturing leadership.

One consequence is that the Department of Defense is becoming increasingly dependent on foreign-sourced hardware and technology in the acquisition of the technologically superior weapon systems that are fundamental to our strategy of offsetting numerical inferiority with technological superiority. We cannot reasonably expect to offset potential adversaries' numerical superiority with only technological equivalence.

We do not know how these developments ultimately will affect our security. We do know that they give cause for concern. Our capacity to build or replace critical force structure independently of economic and political decisions of other sovereign powers is essential to our security. The Department of Defense must ensure that its actions and policies, as well as the actions and policies of other Government institutions, do not weaken our manufacturing sector and thereby degrade the United States' security posture.

As we look to the future, two fundamental problems threaten Department of Defense capabilities to maintain a modern inventory of technologically and qualitatively superior military equipment. The first is the environment in which the Department of Defense and industry conduct business. The high and rising costs of our major weapon systems appear driven by an acquisition system that encourages long acquisition cycles, high development and production costs, and sometimes obsolete technology. This increasingly burdensome environment is a cause of continuing difficulties in the Department's efforts to fulfill its responsibilities to the nation for effective, efficient procurement of major systems.

The first problem is exacerbated by the second — aspects of fiscal and monetary policy and the costs imposed on industry by some necessary but nevertheless expensive domestic policies. Department of Defense-related causes of problems associated with the declining competitiveness of American manufacturing industries are not the only causes of problems within the defense sector. The underlying causes of national competitiveness

problems also apply in every respect to firms within the defense industrial base. However, defense-related problems cannot be solved if the broader national-level problems are not resolved. Industry clearly is appealing for the Congress and the Executive Branch to understand and appreciate better the total impact of Government actions and to provide improved coordination and consistency of national policy.

Many congressional and executive intrusions into the market have negative impacts on the competitiveness of American manufacturing industries. The tax code, antitrust laws, and Department of Defense acquisition policies frequently discourage investment in domestic production facilities and innovation by domestic producers. Some elements of United States law more appropriate when America was a more self-contained economy now are harmful to American industry in the international market. Actions to adjust these laws to the conditions of a more international marketplace have been slow and inadequate.

The Department of Defense can contribute to solutions, but cannot unilaterally provide them. Effective solutions will require the cooperative efforts of the Congress, Executive Branch departments and agencies, and the public. We hope that this report will stimulate the beginning of that cooperative effort.

The following chapters: explain more fully the reasons for Department of Defense concerns about United States industrial vitality; discuss the nature and scope of our competitiveness problems and the Department's role in addressing them; explore the causes of and potential solutions to underlying long-term problems; and, finally, offer recommendations for action.

CHAPTER II

THE COMPETITIVENESS DEBATE

A decade of debate about *industrial policy*, as well as today's concern with *competitiveness*, are reflections of major structural shifts in our economy. The many indicators of these changes include the declining role of the goods producing sector and the rising importance of foreign trade and the increasing integration of world capital markets.

This section begins with a brief review of the debate between public policy specialists we surveyed who warn of a broad competitive decline and those who believe that America's industrial performance has been relatively good. These two groups are far apart on their interpretation of *the facts* and correspondingly far apart on their recommendations for action. There are, however, some areas of agreement between them and considerable agreement about the role and responsibilities of the Department of Defense. Framing Department of Defense actions in the context of these larger economic and industrial issues allows the segregation of the Department's policies and responsibilities from those of other agencies and highlights broad areas of policy interplay associated with Department of Defense concerns.

A. UNITED STATES COMPETITIVENESS

The gauge by which analysts have measured United States competitiveness is itself a matter of intense debate. The President's Commission on Industrial Competitiveness and other recent studies have settled on the following definition: *competitiveness for a nation is the degree to which it can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining and expanding the real incomes of its citizens*. According to these studies, statistics on real wages, the trade balance, productivity growth, innovation, and human resources present a bleak picture of America's competitive status. These studies generally contend that these competitive weaknesses are deep-seated, structural, and not quickly remedied. Similarly, they forecast dire consequences if they are not reversed.

Sectoral Decline

In addition to the macro-economic indicators discussed above, some analysts have been concerned with competitive decline at the sectoral level. In particular, they are concerned with the decline of *strategic* sectors.

There are two senses of the term *strategic industry*: strategic for economic growth, and strategic for security. The Department of Defense concerns are most obvious with respect to the key defense-related industries that largely determine both the quality of our instruments of deterrence and the scope of an American response to aggression should deterrence fail. However, strategic industries, in the economic sense of the term, also are of concern.

These economically strategic industries are, by and large, research-intensive industries or industries that exhibit important technological spillovers or *linkages* from one industry to another. Perhaps the best example of such an industry is the semiconductor industry. Semiconductors have been responsible for technical revolutions in supercomputers, home appliances, automobiles, telecommunications, energy, and many other products. The telecommunications industry may be another *strategic* industry, with the potential to stimulate broad cost reductions in communications, decision making, and control technologies. The low-cost availability of energy also provides a *strategic leg-up* to American firms in their ability to be cost competitive.¹ Other *strategic* industries might include computers, office equipment, construction and mining machinery, instruments, and many types of manufacturing equipment, based on their tendency to *export* technology to other industries. Each of these industries has important *linkages* to other industries. They are believed to be essential to long-term economic growth and competitiveness.²

The United States historically has been a world leader in the exploration and development of such strategic technologies. Some observers are concerned that even in such technologies, American performance has begun to slide.³

¹See Peter T. Jones and David J. Teece, "Research Agenda on Competitiveness," Berkeley Business School, Berkeley, CA, 1987, pp. 45-51.

²F.M. Scherer, *Innovation and Growth*, MIT Press, 1984, esp. Chapter 3, "Interindustry Technology Flows in the United States," pp. 32-58.

³W. Finan, *et al*, "The U.S. Trade Position in High Technology: 1980-1986," Joint Economic Committee, U.S. Congress, Washington, D.C., 1986.

It is alleged that the Japanese, in particular, understand the importance of these linkages and that they strategically orchestrate public policy -- in the form of research and development subsidies and protected domestic markets -- to capture vital market shares in these strategic industries. American trade policy institutions have heretofore rejected this approach and are believed by many to be incapable of mounting a strategy to counter active foreign trade policies. Some analysts believe, therefore, that new institutions are required to accomplish these important tasks.

B. OPPOSING VIEWS — SMART PEOPLE DISAGREE⁴

There are at least three grounds for disagreement about competitive conditions in the United States among those who have examined the issues carefully. There are methodological disputes, disagreements about the interpretation of macroeconomic events, and disagreements about the interpretation of sectoral economic events. These are discussed in this section. There are also areas of agreement, which are discussed in the following section. It is in these latter areas that the Department of Defense can most effectively contribute by using its influence in the economic policy arena.

Methodological disagreements pervade the competitiveness debate. Disputes concern both the nature of economic causation (and therefore the selection of the economic phenomena to be explored) and the accuracy of various measures of economic health. On the issue of what causes countries to export and import the mix of commodities they do, for example, (an issue of central importance to understanding international competitiveness), there are differences in approach. While some focus on the distribution of existing stocks of physical and human resources between countries to justify the changing patterns of trade (the so-called "comparative advantage"), others concentrate on the capability for collective action to

⁴See, for example, R.Z. Lawrence, *Can America Compete?* Brookings Institution, 1984; *U.S. International Competitiveness: Perception and Reality*, New York Stock Exchange, Office of Economic Research, August 1984; "Industrial Change and Public Policy," The Federal Reserve Bank of Kansas City, August 1983; and R.D. Norton "Industrial Policy and American Renewal," *Journal of Economic Literature*, March 1986.

purposefully alter patterns of trade. The process of economic causation that underlies these two views is the subject of continuing debate.⁵

Another very important methodological issue concerns the definition of *competitiveness*. The definition given in the previous section is absolute. Competitiveness is measured only by America's ability to achieve certain objectives. Others have approached the issue from the standpoint of our economy's performance relative to our major competitors, as well as to our own past performance, and have found the United States to be competitive. From this relative perspective, American performance is claimed to have been good with respect to: manufacturing employment, capital formation, research and development spending, productivity, and the responsiveness of our economy in shifting from low-growth to high-growth industries.⁶

A final methodological issue is the selection of evidence for assessing competitiveness. There are definite limits on the quality and applicability of the various indicators of economic vitality.⁷ These limits are only rarely discussed by advocates of the various policy positions.

Legitimate disagreement also attends the interpretation of the macro-economic evidence of economic decline. As pointed out in the discussion of methodological issues above, for example, some of the phenomena that constitute evidence of absolute competitive decline may at the same time provide evidence of relative economic success. Moreover, some have argued that the causes of any *apparent* deterioration of our international competitiveness have been macro-economic in nature, for example, strong domestic economic growth relative to our major competitors and exchange rate patterns, rather than resulting from

⁵Krugman, in *Industrial Change and Public Policy*, *op. cit.*, pp. 139-153 and "Is Free Trade Passe?", *Economic Perspective*, Fall 1987; Robert M. Stern, "Testing Trade Theories," in P.B. Kenan (ed), *International Trade and Finance: Frontiers of Research*, Cambridge University Press, 1976; and Linda Hasselman, "Trends in European Industrial Intervention" *Cambridge Journal of Economics* (7) 1983, esp. pp. 204-206.

⁶Lawrence, *op. cit.*, pp 23-25.

⁷For a review of the quality of various economic indicators see *Supplement to Economic Indicators: Historical and Descriptive Background*, Joint Economic Committee, U.S. Congress, Washington, D.C., 1980; and F.J. Fabbozzi and H.I. Greenfield (eds), *The Handbook of Econonomical and Financial Measures*, Dow Jones, 1984.

weaknesses of particular industries, low productivity, high unit labor costs, trade policies of competitor nations, or other presumed underlying weaknesses.⁸

There is also contention surrounding the appropriate public policy response to industry-specific events. In the first place, it is argued that the process of capitalist economic development is, has always been, and should be, one of continuing rise and fall of industries. Moreover, most *industries* are comprised of intra-sectoral strategic groups that respond quite differently to changing business conditions. While a broadly-defined industry may be experiencing decline, some of its strategic groups may be performing quite competitively. Policy aimed at encouraging *industry* health may discourage the competitive performance or health of intra-industry segments.

Finally, serious doubts have been expressed about our capability to define a reasonable standard through which to foster particular industries. Our capability to successfully pick *winners* and *losers* is believed by many to be inadequate.⁹

C. AREAS OF AGREEMENT

Despite the many disagreements about the nature, scope, and policy implications of American competitiveness, there are many areas of agreement among analysts who seriously have assessed our competitive posture. In this section, the most important of these are discussed. The Department of Defense must act with caution in exercising its influence in such a non-traditional policy area. By focusing its efforts on policy areas where broad agreement exists among experts, the Department can exercise appropriate prudence and at the same time not be paralyzed by disputes about difficult issues and policy choices.

First, most agree that the nature and causes of American competitive positions are very complex. Remedies must be multi-dimensional and probably will yield results only over the long term.

⁸See, for example, *The Economic Report of the President*, 1987, pp. 97-123; and J.C. Hilke and P.B. Nelson, *International Competitiveness and the Trade Deficit*, Federal Trade Commission, May 1987.

⁹See Krugman, "Targeted Industrial Policies: Theory and Evidence," in *Industrial Change and Public Policy*, *op.cit.*; and C. Schultze, "Industrial Policy: A Dissent" *Brookings Review*, Fall 1983, pp. 3-12.

Second, most agree that we have a host of policies, laws and regulations -- tax laws, monetary policies, antitrust laws, export controls, laws protecting intellectual property rights, congressional appropriations, customs duties -- that constitute the environment in which domestic and foreign enterprises conduct business. There is further broad agreement that this *de facto industrial policy* is, at best, incoherent and, at worst, counterproductive. Some effort should be taken to correct this situation to the degree that our political traditions allow.

Third, there is substantial agreement concerning many trade-related issues, including the perception that progress toward free world trade is increasingly threatened by protectionist sentiments and trading practices not regulated by the General Agreement on Tariffs and Trade. There are, of course, major disagreements on what to do about these shared perceptions.

Fourth, there is considerable agreement on the need for increased analytical capability for determining the extent of foreign and domestic Government support for industry and for assessing the inconsistencies in our domestic policies toward industry.

Fifth, there is keen recognition that several sectors of our economy have suffered setbacks in the face of international competition, but that the visibility of these industries has tended to overshadow the vitality of many other sectors from which lessons can be learned.

Sixth, in the areas of education policy, tax policy, research and development policy, and regulatory policy, there is much that is not being done, but that could be done, to improve the quality and flexibility of our nation's pool of human resources and the ability of our industries to compete more effectively in the international marketplace.

Finally, most agree the Department of Defense has a unique responsibility to formulate coherent policies both to foster a reliable defense industrial base and to reduce the cost of its purchases. It is further recognized that the Department has a unique responsibility to mitigate threats to our security posture which arise from distortions of normal patterns of industrial growth and development.

D. SUMMARY AND CONCLUSIONS

The analytical and policy problems that shape the debate on American competitiveness are extremely complex. It is clear that America's economy is in the midst of a period of structural adjustment. This adjustment has spawned an intense economic policy debate about the appropriate response to the changing composition of American industry. The Department of Defense has a stake in the outcome of the debate, both because the overall health of the economy is important to the Defense mission and because of the vexing issues that surround the health of particular industries upon which our defense is dependent.

Our response must have two major thrusts. First, there are broad areas of agreement among policy analysts for the need to develop rational and effective linkages among the practices, regulations, and laws that together define the environment in which our industries operate. Although the Department is not responsible for economic policy, the Department of Defense must do its part to foster and cooperate in such an effort. Second, the Department of Defense must develop a strategy to improve the capabilities of the defense industrial base. Such a capability has two parts. One is the capability to coordinate acquisition policy. This is in itself a difficult political problem requiring the cooperation of the Military Departments and of the Congress. This capability must draw upon recent progress stimulated by the report of the President's Blue Ribbon Commission on Defense Management (the *Packard Commission*), the creation of the position of Under Secretary of Defense (Acquisition), and the Defense Reorganization Act in general. At the same time, the Department of Defense requires a synchronized capability to analyze the structure and performance of *critical industries*; the impacts on these industries of changes in economic policy, acquisition policy, and conditions of international trade; and the development and evaluation of policy instruments aimed at fostering a healthy defense industrial base and contributing to sustainment of a healthy national industrial base.

CHAPTER III

NATIONAL POLICY ISSUES

The United States Government focus on the domestic marketplace generally has emphasized protecting the public against business excesses, rather than also promoting the health of American industries. Nevertheless, the fundamental characteristics of the United States economic system have provided an environment conducive to business success. The freedom to reap the rewards of hard work and innovation has stimulated the creation of enormous wealth, providing American industries with the resources and markets necessary to lead the world in output and technology. In essence, American businesses have not needed Government support to flourish, although these businesses have benefited from research and development funding and purchases tied to Government programs.

While the strengths of the United States economic system have not changed, the market environment for American industries has. The change has been caused by two trends:

- Physical barriers to international trade have been greatly reduced by advances in transportation and communication technologies, causing an evolution from separate national markets to a single, integrated world market;
- Foreign governments have adopted aggressive strategies of economic development, through direct and indirect subsidies to develop and maintain indigenous industries, the promotion of exports, and the creation of import barriers.

United States institutions have not responded adequately or quickly enough to basic shifts in economic and manufacturing power among nations. More recently, American technological leadership also has begun to erode. Effective remedial actions are possible, given the national will to undertake them. However, many of the options available to the nation are beyond the traditional scope of responsibility and authority of the Department of Defense. Nevertheless, these options are critically important to the nation's security, and, in the process of addressing them, a security viewpoint must be considered.

This section summarizes a range of views on the underlying causes of declining American industrial competitiveness, as identified by both Government and private-sector participants in this effort. Not surprisingly, the causes they identified are consistent with those

identified in the report of the President's Commission on Industrial Competitiveness and in a great many recent private-sector examinations of the problem.

In this section, causes of the competitiveness problem are grouped into three major categories. The first category addresses management issues. These are particularly sensitive for Government to address without unacceptable intrusions into the private sector. Nevertheless, management is an issue that must be addressed in a continuing public forum on the future economic well-being and security of the United States.

The second category addresses Federal Government policies and practices that directly or indirectly affect the competitiveness of American industry. The third category addresses educational and cultural issues. Education issues might properly be a sub-set of the Government policies category, but are grouped separately because they are long-term and fundamental in nature, and involve Government at all levels, as well as the private sector. This category also addresses national cultural issues, which are broad, common, and inherently difficult to resolve. The Department of Defense has little capability to address or to influence these issues. Even the civil agencies and departments will find these difficult to address. There clearly is a role for the Government, however, beginning with the need to stimulate greater awareness of the problems we face and to build a national consensus to resolve them.

A. MANUFACTURING MANAGEMENT ISSUES

Management issues consistently were identified by participants from industry and academia as the most important causes of declining American industrial competitiveness. There was a general consensus among these participants that American management culture and practices are less effective in the global marketplace than those of foreign firms. Industrial and academic participants in this effort identified numerous specific management practices they considered harmful to American competitiveness.

There are historical reasons for current deficiencies. In the 1950s and 1960s, American industry dominated world manufacturing. American manufacturers could focus on quantity to the neglect of quality. American manufacturers were complacent, while other countries began building powerful new industrial infrastructures and developing superior process technology to manufacture easily-obtained American product designs and

technology. Among the results of this period that persist today are many senior managers who continue to view the nature of markets as national, not international, and the nature of product requirements as *good enough*, not *world class*.

B. GOVERNMENT POLICIES AND PRACTICES

Many Federal Government policies and practices reduce the competitiveness of American manufacturing companies. These policies and practices tend to be concentrated in the areas of tax, regulation, and antitrust enforcement, but they also range broadly over a number of other areas, including government attitudes toward domestic industry.

Some of America's trading partners have taken an aggressive approach to gaining, maintaining, and expanding market share in the United States, with substantial assistance from their governments. Other governments have helped give key technologies a head start and helped coordinate development, marketing, and pricing approaches by their manufacturers. In addition to aiding their own industries' technological efforts and exports, other governments have also created formidable non-tariff and tariff barriers to imports. The policies of other governments to subsidize and protect their industries are not matched by the United States Government. United States Government policies and actions to *level the playing field* in international trade have been inadequate.

Stronger, more focused efforts are required to create a "level playing field," particularly with respect to manufactured products. For example, United States tax laws should differentiate between *wealth-producing* activities and *wealth-redistributing* activities in treating amortization and depreciation. Productive investment could receive more favorable tax treatment than such activities as stock market speculation. Rare instances of United States Government efforts to foster domestic manufacturing are best characterized as efforts to correct the results of prior neglect, and usually focus on lagging rather than leading industries.

United States Government neglect of industrial competitiveness extends beyond the capital base and industrial technology. Compared with some other governments, the United States Government also has done very little to provide or to stimulate worker training and re-training programs in manufacturing. Limited efforts thus far have emphasized

retraining workers from declining industries, and some officials believe that even such limited efforts are best left to the private sector.

The absence of a focal point in the United States Government to analyze comprehensively our policies and practices toward the industrial base in such areas as tax laws, procurement rules, research and development policy, and technology transfer policy seriously limits the Government's ability to evaluate the elements of American competitiveness. In addition, the lack of sufficient knowledge of the potential impact of proposed laws or policies on the industrial base often causes inadvertent but harmful results.

Many congressional and executive intrusions into the market have negative impacts on the competitiveness of American manufacturing industries. The tax code, antitrust laws, and Department of Defense acquisition policies frequently discourage investment in domestic production facilities and innovation by domestic producers. Some elements of United States law, appropriate when the United States was a more self-contained economy, now are harmful to American industry in a global market. Actions to adjust these laws to the conditions of a more international marketplace have been slow and inadequate.

Modern telecommunications and transportation systems have reduced significantly the barriers to international trade by reducing *long-distance* costs. This has enabled producers to compete for market share external to their domestic markets. Other countries, particularly Japan, have taken advantage of this new market environment. American producers, however, have been slow to respond. For example, while total United States investment in research and development is proportionately equivalent to that of Japan, the Japanese do not invest heavily in defense research and development. Consequently, they are able to invest proportionally more in research and development for commercial products and processes. They also invest more in capital equipment. Relative to Japan, American firms are *underinvested*. The Japanese worker reportedly is supported by about \$48,000 in capital investment in contrast to about \$32,000 for the American worker.

Tax Policies

The absence of incentives in tax law for training of the workforce, investment in new plant, equipment, and process technology, and doubts about continuation of incentives

for research and development detract from the ability of American industry to remain competitive. Relative to other industrialized nations, America's tax system provides little or no incentive for long-term investments. Capital gains and earnings on savings and investments are taxed as ordinary income at relatively high rates, while consumption generally is taxed at a low rate, if at all. This stimulates consumption rather than saving, and results in reduced capital for industrial modernization and technological development.

Elimination of tax incentives for domestic investment has reinforced the trend to foreign sourcing and reduced the potentially beneficial effects of a weaker dollar on investment decisions of American firms. A corollary effect of the elimination of investment tax incentives in 1986 is a weakening of the domestic supplier base. These effects of tax law changes may be partially offset in the future by lower tax rates, but the nature and extent of the impact of lower rates on investment decisions are not yet apparent.

The American tax system at all levels of government places a heavy tax burden on American industry (for example: income, property, and labor taxes) but not on equivalent products manufactured elsewhere and sold in the United States. Many countries use a value-added tax to ensure that the products of both domestic and foreign producers are taxed equally and fairly, and, because of the value-added tax, are able to minimize other direct (and unequal) taxes on their domestic industries.

Regulatory Policies

During the decades of the 1960s and 1970s, American requirements for emissions, safety, and environmental controls imposed large *non-productive* costs on American manufacturers at the expense of additional investments in productivity improvements. This broad range of socially desirable laws had, and continues to have, a major impact on manufacturing costs in the United States and, in some industries (forgings, castings, and specialty chemicals), has severely damaged American industries' ability to compete. These controls, as well as the costs of documenting compliance with other requirements, such as equal employment opportunity, are indirect but substantial taxes imposed on the products of American manufacturers but not on foreign products sold in the United States. Similar environmental requirements are now being imposed by some governments elsewhere, but industries in these countries are able to apply American-developed technologies at much lower

cost than was incurred by the American industries that were forced to develop the technologies, as well as to implement them.

Product liability laws and court awards are becoming a major issue in the United States. Test and evaluation requirements necessary to protect firms against lawsuits are becoming very costly. The problem is magnified by the tendency of the courts to hold the original manufacturer responsible, even when substandard replacement parts have been used in the product. The impact on American manufacturers is generally much greater because these manufacturers are liable for the products sold to American consumers during the 1960s and 1970s when foreign products had made few inroads into the United States market. In some cases, American firms are forced to raise the prices of new products to enable them to cover the liability costs associated with products 20 or 30 years old.

Antitrust Policies

As American industries increasingly are pitted against foreign government-led consortia, restrictions imposed by the Sherman Antitrust Act, the Robinson-Patman Act, the Clayton Act, and other antitrust laws become increasingly irrelevant and harmful to the international competitiveness of American industry. In particular, antitrust laws and regulations that impede cooperative research and development by American firms in both process and product technology are harmful. Restrictions were eased by the provisions of the National Cooperative Research Act of 1984. But many manufacturers still feel constrained by continuing uncertainty with respect to applications of this body of law, which still creates substantial risks for companies in joint ventures.

Currency Exchange Rates

The high value of the dollar in recent years, relative to our major trading partners' currencies (notably the Japanese yen and West German mark), made American-manufactured goods less competitive in world markets (including in the United States). It also influenced business decisions of American manufacturers -- encouraging foreign-sourcing, migration of manufacturing facilities, deferral of American factory or product upgrades, and redeployment of capital out of manufacturing altogether. Exchange rates

enabled American firms to purchase products and to invest in facilities overseas at less cost than in the United States. Even with a weaker dollar, it has proven difficult to reverse the trend. However, exports of manufactured products recently have surged and there are preliminary indications of investment decision trends favoring United States facilities rather than foreign.

C. EDUCATIONAL AND CULTURAL ISSUES

The American educational system does not produce the required numbers and skill levels of scientists, engineers, and technicians to support advanced manufacturing needs. Evidence suggests that the manufacturing workforce in some other countries may be better educated and trained than in the United States. For example, Japanese high school graduates appear to be much better educated in math, science, and technology than their American counterparts.

Skill levels of many American high school graduates are not adequate, and firms often must invest in programs to upgrade basic reading and math skills. Such results suggest that a system of high-quality technical schools providing skills in applied mathematics, machining, manufacturing methods and technologies, and fundamentals of technology management could be an effective means of providing highly skilled and motivated workers. Such a system might provide a constructive alternative for students who do not wish to or are unable to pursue a university education.

In large measure, the inability of American managers to achieve results in manufacturing equal to those of Japanese managers in the United States stems from management theory and practice, as taught in American universities (where for example, good management is management by financial control; good managers can manage anything; individual achievement is important, not teamwork; manufacturing is an unimportant function). Engineering schools in American universities also focus inadequately on manufacturing, training engineers for careers in product research and development. Few faculty members have industrial experience or expertise. Emphasis on specialization results in engineering professionals who are ill-equipped to understand total manufacturing systems.

There also is an increasingly severe shortage of adequately trained scientific and engineering students flowing from American universities. American industrial laboratories and graduate schools in science and engineering are heavily populated by citizens of other countries. Almost half of the students in American graduate science and engineering schools are foreign.

Beyond the university level, American industry lacks adequate programs to provide continuing professional education and training to engineers and production workers. Continuing education and training programs in American industrial firms are often weak, ineffective, or non-existent. Stimulation of continuing education and training through tax incentives, Department of Defense contract incentives and other Government efforts could be highly-productive and cost-effective.

American industrial competitiveness problems also are affected by a number of issues that can accurately be characterized as endemic to the American business culture. Clearly endemic problems, as discussed below, are among the most difficult to address effectively or to resolve. Equally clear, changes can be achieved only through broad national understanding and cooperative efforts.

Fundamental Skills

There is a widely perceived failure of American institutions to instill basic skills in our citizens. The general lack of familiarity with foreign languages and cultures in the United States population detracts from American international competitiveness. In years past, American business had little need to understand foreign markets. The United States economy consumed such a large portion of manufactured goods produced worldwide that foreign markets were not particularly important. Moreover, American goods were so superior to foreign goods that little competition existed for foreign sales. However, these market conditions have long since changed. The United States economy's share of total world consumption has declined substantially, and foreign-made products have equaled or surpassed their American-made counterparts in many instances. American society has been slow to respond to these changes. American products are less competitive in foreign markets because they are rarely designed to appeal to the cultural peculiarities of foreign consumers. American businessmen are at a disadvantage with their foreign competitors in understanding overseas mar-

kets and accessing technological advances made in these markets due to a general lack of foreign language skills. Language barriers pose a particularly difficult problem for American firms. Japanese and Europeans need only learn English to compete effectively in the world's largest market, but Americans must learn several languages to be as effective overseas.

There has been too little stimulus for the national effort required to change national attitudes toward work, to improve our educational systems, to emphasize needed skills, and to eliminate Government policies which adversely affect American performance in the world marketplace.

Awareness of the Problem

The absence of a national understanding (and Department of Defense understanding) that a healthy, productive manufacturing base is essential to our security greatly complicates efforts to develop and implement remedial measures. Manufacturing strength is needed to ensure that our armed forces can acquire the best weapons, and in quantities needed, to deter and defeat potential adversaries. Such strength encompasses commercial, as well as military production capacity. Commercial capacity adds the financial strength necessary to support research and development and capital investment and provides production resources that could be converted or diverted to military needs under emergency conditions.

Adversarial Relations

The deeply ingrained adversarial relationships between Government and industry and between management and labor are major causes of declining American industrial competitiveness. The relationship between the Government and industry is characterized by Government constraints on industry behavior intended to protect the public good against profiteering and shoddy performance; and by industry performance *by the numbers* to stay within Government constraints and to document compliance. The relationship between management and labor also is adversarial.

These adversarial relationships undermine industrial efficiency, responsiveness, and technological innovation. This Government-industry relationship forces industry to operate within an extremely restrictive environment and discourages (or even penalizes) innova-

tive behavior. Considerable industry effort is invested in satisfying Government paperwork requirements and responding to Government meddling in the manufacturing process.

The management-labor relationship prevents cooperative efforts to identify and implement innovative processes and tends to hold labor productivity to some minimal standard, actively inhibiting any worker capability or desire to improve. Historical barriers to cooperation between management and labor are only beginning to fall, and at much too slow a rate. There is not yet a pervasive sense of shared interests and objectives for the common good.

Other countries (Japan in particular) are much more effective than the United States in achieving industry/Government/labor cooperation on process and product development, and, through cooperation, are more effective in implementing new ideas to make manufacturing more efficient, responsive, and technologically advanced.

Short-Term Focus

American society, historically, has been action oriented and sharply focused on quick results. The short-term expectations that pervade American society have become a major impediment to the long-term planning necessary to compete effectively with other countries.

The equity market is the major source of capital for American industry, in contrast to Japan, where commercial banks are the principal providers of capital to industry. The American stock market is driven by short-term expectations, whereas Japanese banks historically have supported long-term investment. Short-term pressures in the American stock market are increasingly being exacerbated by large institutional investors, whose managers themselves are evaluated on short-term performance. Many of these are non-profit funds (for example, pension funds) that are free to move quickly in the market without regard for tax consequences, and, therefore, to increase the short-term volatility of the market.

Short-term profit expectation has emerged as an important reason for the relative lack of effectiveness of American technology-based businesses. There is a lack of understanding and acceptance in the investment community and the general public of the need for *decade plans* for technology-based businesses. Financial markets that place a premium on

short-term results may penalize a long-term orientation by reduced stock values, forced mergers, or hostile takeovers. Conversely, the Japanese (in particular) and Europeans are oriented more toward long-term results, with increasing success.

Lack of Manufacturing Prestige

The attitude in the United States toward manufacturing and manufacturing technology is somewhat negative. American universities have little to offer in these fields. Even within the manufacturing firm, research and design engineers are perceived to have more prestige than manufacturing engineers. One result is that the manufacturing function does not compete effectively for high-quality personnel. (Conversely, the Japanese have a high regard for manufacturing and are totally committed to innovation in both process and product.) These attitudes (and resultant rewards systems) toward manufacturing careers often prevent the best people from beginning or sustaining careers in manufacturing.

CHAPTER IV

DEFENSE POLICY ISSUES

In seeking more comprehensive information on the health of the defense industrial base, the Department of Defense sought to evaluate whether the overall strength of our industrial base masks any weaknesses in individual defense-critical industries.

The Defense Economic Impact Modeling System and other tools were used to identify defense-critical industries. Critical industries are those in which the majority of the Department of Defense budget is spent, directly and indirectly, as well as industries vital to defense production. Two hundred fifteen individual industries were identified, accounting for about 95 percent of Department of Defense purchases from the manufacturing sector. A series of six indicators was developed and applied to each industry: import share of the domestic market; growth in capacity; growth in shipments; capital expenditures expressed as a ratio to industry shipments; productivity growth; and profitability. Comparisons based on the indicators were then drawn between defense-critical industries and the overall United States manufacturing sector. Finally, a ranking of the critical defense industries based on a composite of all six indicators identified defense-critical industries with the poorest overall performance.

Based on this review, which covers the period from 1980 through 1985, we drew the following conclusions:

- Critical defense industries did no worse than overall manufacturers in maintaining a domestic market share in the face of substantial import growth;
- Critical defense industries did worse than overall manufacturers in terms of adding to productive capacity, with only 41 percent of critical defense industries matching or exceeding the overall manufacturing average growth in productive capacity;
- Three-quarters of critical defense industries achieved worse than average growth in real shipments;
- Sixty-two percent of critical defense industries had lower-than-average capital expenditures in 1980. This adverse trend continued in 1985, when 72 percent had lower-than-average capital expenditures;

- Forty-seven percent of critical defense industries had below-average productivity growth (17 actually had declining productivity);
- Critical defense industries achieved average or above average profitability.

These trends, while not definitive, are disturbing, particularly, with respect to indicators of future productivity and competitiveness.

A. THE DEPARTMENT OF DEFENSE MISSION

The mission of the Department of Defense is to provide for the common defense. Political and strategic realities require this to be accomplished through a worldwide military command structure. At the heart of the deterrent power of the United States military presence is an inventory of sophisticated military equipment and the human resources to manage and operate it. These resources are drawn and replenished, in large part, from the same pool of resources that fuel the general industrial economy.

As we look to the future, two fundamental problems threaten Department of Defense capabilities to maintain a modern inventory of qualitatively superior military equipment. The first is the environment in which the Department of Defense and industry conduct business. The high and rising costs of our major weapon systems appear driven by an acquisition system that encourages long acquisition cycles, high development and production costs, and sometimes obsolete technology. These problems most recently have been addressed by the *Packard Commission*. Some of the recommendations of the Commission have been implemented, others are in the process of being implemented, and others are under active consideration.

Yet, even if all of the Commission's recommendations were adopted and proved to be effective, a second problem would remain: many of the strategic industrial sectors that support the production of modern weapon systems are being threatened by intense, long-term competitive pressures from foreign producers. These include: semiconductors and semiconductor equipment, shipbuilding, automobiles, construction equipment, machine tools,

flexible manufacturing systems, ball and roller bearings, castings, forgings, steel, and ceramics, to list a few.¹

We do not know with any degree of certainty how these developments ultimately will affect our national security. We do know that they give cause for concern. Our capacity to build or replace critical force structures independently of economic and political decisions of other sovereign powers is essential to our security. The Department of Defense, therefore, must ensure that its actions and policies (especially, but not exclusively, in the acquisition arena), as well as the actions and policies of other government institutions, do not weaken our manufacturing sector and thereby degrade our defense posture.

Department of Defense action must be sensitive to the general economic health of the nation. The Department's concern for the health of the manufacturing sector and for individual industries within that sector should not be construed as an endorsement of sectoral policies for the economy as a whole. On the other hand, the Department's competitiveness initiative has identified a number of national policy initiatives aimed at bolstering the general health of the manufacturing sector, and it is appropriate for the Department to provide a security perspective to influence actions by the appropriate agencies.

Neither the nation nor the Department of Defense can afford policies which do nothing but protect failing industries or firms. Not only would these aggravate the weapon systems cost-growth problems identified by the *Packard Commission*, but, in the absence of counteracting incentives, such protection would undermine the competitiveness that this Department of Defense initiative aims to achieve. Protectionism also would be a threat to cooperative production agreements with our allies. The United States has encouraged a *two-way street* in military trade with our allies primarily as a means of balancing the costs of military alliances. The abrogation of such agreements by domestic interests may result in higher costs, reduced competitiveness, loss of interoperability, and, to this extent, should continue to be discouraged.

¹*U.S. Industrial Base Dependence/Vulnerability*, Roderick L. Vawter, National Defense University, December 1986. Our sense of the term "strategic industry" is discussed in chapter II of this report.

B. SECURITY CONCERNS

From one perspective, there are at least four reasons why the Department of Defense is, and should be, concerned about the overall competitive health of the United States manufacturing base.

First, the Department has a direct responsibility toward the sectors of the economy that constitute the defense industrial base. In many of the transactions between the Department and the industries that produce the instruments of military deterrence, the influences of Government procurement regulations and a single-buyer market structure have created a unique business environment. The Department of Defense must pay close attention to how its policies (and the policies of other Government agencies and institutions) affect this business environment and the extent to which the ultimate objectives of assuring our security are served by this environment.

Second, the vitality of our manufacturing economy in general ultimately determines the war-fighting power of our nation's force structure. The economy's latent capability to enhance current forces in response to strategic threats is a critical element of our deterrence strategy.

Third, the Department of Defense is cognizant of its formative influence on the larger manufacturing economy. Through its impact on the employment of scientists, engineers, and factory workers, its research and development expenditures (particularly in advanced manufacturing technologies), and its role in fostering capital investment, the Department's influence on innovation and manufacturing far exceeds its relatively small share of expenditures in our national income accounts.

Finally, the weapon systems for our nation's defense are purchased, in the long-run, from revenues generated by a healthy and growing economy. Such economic growth has allowed the nation to pay for its defense. For many years, the cost of our worldwide security obligations has been less than seven percent of our gross national product.

C. DEPARTMENT OF DEFENSE CONCERNS

The report of the Defense Science Board Task Force on Defense Semiconductor Dependency published in February 1987 was directed specifically at the semiconductor problem, but many of its findings and conclusions are equally applicable to other lower-tier industries that, collectively, provide the technological backbone of advanced weapon systems.

Competitive pressures, particularly from Japan and the newly emerging, economically competitive countries of Asia — Taiwan, Hong Kong, Singapore, and Korea — as well as Western Europe, are contributing to the relative decline of industries that are important to America's defense. As in the semiconductor case, the Department of Defense is the buyer of relatively small portions of these industries' total output, but, nevertheless, is absolutely dependent on these industries for its weapon systems. In most of these industries, volume production for commercial markets is essential to controlling unit costs and maintaining world class standards of quality.

As the commercial base has eroded, technology leadership also has moved, or is moving, offshore because technology leadership is dependent on the commercial base for revenues to support research, development, and investment. Thus, while the Department of Defense has no direct responsibility for ensuring the vitality of commercial manufacturing in the United States, it is unable to meet its mission requirements effectively without a broadly capable industrial base.

In a growing number of industry segments, if current trends continue, the Department of Defense will be dependent on foreign-sourced hardware and technology in the acquisition of the technologically superior weapon systems that are fundamental to our strategy of offsetting numerical inferiority with technological superiority. Specific elements of Department of Defense concerns are discussed in the remaining paragraphs of this section.

Technology Leadership

There is a substantial body of evidence that technological leadership is irrevocably tied to manufacturing capacity and leadership. The revenues generated by successful manufacturing are essential to achieving and maintaining the levels of research and

development required for technological leadership. Without technological leadership, the Department of Defense cannot count on industry's ability to produce affordable, high-quality, state-of-the-art weapon systems. In many industry sectors that are key to defense production, the manufacturing base has declined, and as a result the Department of Defense (and the United States generally) is now beginning to experience the reality of declining technological leadership.

Foreign Ownership of American Manufacturing Facilities

The issue of foreign ownership of American manufacturing facilities has not received adequate attention. The most common view is that the rapidly increasing level of foreign ownership is beneficial to the United States. In this view, such investment reduces the magnitude of the trade deficit, provides jobs for Americans, and increases domestic tax revenues. This view overlooks economic issues such as the long-term impact on the current account of a continuing flow from the United States of repatriated profits and other fees. More importantly, it overlooks the fact that ownership tends to dictate the geographic location of the underlying technologies. Security concerns are not resolved by domestic manufacturing facilities that are dependent on technologies controlled by other nations.

Manufacturing Technologies

Particularly devastating in the long-term is the loss of key production technologies and equipment. In some vitally important technologies, the battle may already have been lost.

Numerically-controlled and computer numerically-controlled machine tools (developed in the United States with Department of Defense funds) represent one such critical technology where the lead already has shifted. The fact of lost leadership is reflected in procurements by American manufacturers of advanced machine tools from Europe and Japan. Cost is often quoted as a determining factor in the decision to buy foreign tools. Delivery terms are another factor. But the decision is most often made on the basis of quality and advanced features.

Electronics manufacturing equipment is another example of this destructive trend. American semiconductor manufacturers, increasingly hard-pressed by foreign competitors, have survival as their primary goal. In many categories of semiconductor manufacturing equipment, the technological lead clearly has passed to other nations, primarily Japan, and American semiconductor manufacturers are buying Japanese manufacturing equipment because it is the best available.

This is but the leading edge of scores of technologies where other nations are developing the most advanced manufacturing technologies for the most advanced products. Such loss of supremacy in manufacturing technologies is a particularly insidious threat to American technological and manufacturing leadership. As long as foreign state-of-the-art manufacturing equipment continues to be commercially available to American manufacturers (and they elect to purchase it), the decline of equivalent American equipment industries barely is noticed until an evolutionary process reaches crisis proportions.

The decline of manufacturing equipment industries is of particular concern to the Department of Defense. As long as state-of-the-art production equipment is manufactured in the United States, there is a substantial capability to reconstitute or expand American product industries. However, without the basic tools for manufacturing, this capability virtually disappears, leaving United States security vulnerable to the political and economic processes of other nations.

Foreign Dependencies

Foreign sourcing of key parts, components, and complete products is an extensive and growing business practice in both commercial and defense manufacturing. Foreign sourcing may evolve over time into foreign dependencies. Potential foreign dependencies are areas of concern. While this issue has been studied extensively on an *ad hoc* basis, and anecdotal evidence abounds, there are few, even moderately comprehensive studies of foreign-sourced components of key weapon systems.

The potential for divergent political or economic interests to disrupt the free flow of the most advanced technologies and products has never been addressed adequately in the few, limited American assessments of foreign dependencies. There was, perhaps, no need

for such assessments when the United States was the world leader in virtually all militarily critical technologies. This clearly is not the case today. Sole source dependencies on foreign technologies for essential weapon systems components are inherently risky.

D. UNDERLYING CAUSES OF COMPETITIVENESS PROBLEMS IN THE DEFENSE INDUSTRIAL BASE

This section presents brief summaries of Department of Defense-related causes of problems in the defense industrial base. With one exception, the order of presentation is not intended to imply priority or relative importance. The exception, which is considered to be fundamental to further progress in improving the competitiveness of American defense manufacturing industries, is the necessity to establish permanent organizational structures within the Department dedicated to manufacturing excellence.

Program and Budget Instability

Constant budget turbulence, which makes effective long-term planning impossible, and frequent changes in the *rules of the game* (competition requirements, profitability, audit standards, etc.) are major impediments to achieving efficient manufacturing operations. These problems are aggravated by small volume procurements, year-to-year program uncertainties, and program stretch-outs that contribute to an environment in which Department of Defense contractors are unwilling to invest in systems for productivity or quality improvements. The rate of return on such investments is not only low, but uncertain as well. (It should be noted that after-the-fact estimates of the profits of defense firms are contested. The findings of the last major review of profits, the Defense Financial and Investment Review (DFAIR), a 1985 Department of Defense study, are contested by the United States General Accounting Office. The study also has been characterized by a major investment banking firm as "less than carefully conducted.") Despite the lack of precise data, participants in this current effort believe that defense business traditionally has earned a low rate of profit; but that other factors, such as cash flow and certainty of return, have compensated for this. Recent changes are reducing or eliminating these incentives as well. This is particularly damaging in the case of diversified companies or electronics subcontractors, who can -- and do -- disinvest from defense.

Competition, as currently practiced by the Department of Defense, adds another reason for contractors not to invest in product or process research and development because of the likelihood that the Government will require the results of their investment to be transferred to competitors.

Absence of Market Incentives

The absence of normal market incentives in Department of Defense procurements is a barrier to efficient operations. Unit cost reductions, quality improvements, shortened delivery times, etc., do not stimulate demand for additional units or provide greater market share, nor do unit cost reductions result in increased profit (more often, the reverse is true). Increased investment in plant, equipment, training, etc., has no direct bearing on future contracts. A superior product or manufacturing process will not yield either higher profits or improved market share. The absence of such normal market incentives and rewards is compensated for by massive government efforts to prescribe substitute control mechanisms, which are themselves barriers to improvement.

Department of Defense Procurement Policies

In the very forthright views of the experts we consulted, Department of Defense procurement policies and regulations contain many characteristics which inhibit achievement of manufacturing excellence, including:

- Emphasis on price, which forces short cuts and reduces incentives for investments in new equipment and quality systems;
- Evaluation criteria focused totally on product performance, at the expense of producibility and reliability;
- Emphasis on forcing contractors to fund (and assume risk for) program specific tooling, test equipment, etc.;
- The absence of risk-sharing for innovation;
- Emphasis on low acquisition cost and schedule compliance, to the virtual exclusion of low life cycle cost (quality, maintainability, ease of use);

- Intense pressure on profits—down to levels that virtually guarantee the contractor will have very limited ability to invest in future productivity programs.

Department of Defense Organization for Acquisition Management

The manner in which the Department of Defense is organized to manage acquisition is a barrier to efficient manufacturing: functional segmentation (for example, between the procuring contracting officer, administrative contracting officer, plant representatives, Defense Contract Administration Service, Defense Contract Audit Agency, etc.) causes contractors to organize reactively (and defensively) along similar lines, to the detriment of efficient operations.

The organizational problem was exacerbated by lack of discipline in the system. Practices vary significantly from one procurement office to another and from one Military Department to another. Different Government agencies (Defense Contract Administration Service, Air Force Contract Management Division, National Aeronautics and Space Administration, etc.) assigned surveillance responsibilities over multi-divisional companies apply agency/Military Department unique rules, regulations, procedures, etc., with extremely adverse impact on company efficiency and costs. Requirements and procedures are also inconsistent from one type of procurement to another. Different rules apply for production spares and replenishment spares. Primes are required to test purchased components, but the Department of Defense does not test the same components when it buys them directly from the supplier.

Emphasis on Competition

Since the inception of offices of competition advocates in each of the Military Departments and competition advocates in all major buying commands, the Department of Defense has emphasized competition on the basis of initial production price, sometimes virtually ignoring contractors' capabilities and records for quality and timely performance, as well as down-stream (life cycle) costs. Frequently, price competition does not provide the best value to the Government. Emphasis, under the Competition in Contracting Act, on low-cost

bidders favors companies who bid fully depreciated equipment and hurts those with modern facilities. The emphasis should shift to quality and responsiveness.

Product and Process Specification

The Department's heavy reliance upon process and production specifications is frequently counterproductive. Components are required to be manufactured by processes and to standards which are not state-of-the-art and which do not provide the best product at the best price. The manufacturer, who has the greatest expertise, has little voice in component design or manufacturing processes.

Lack of consistency and uniformity in product and process specifications among various Government agencies also has adverse impact on contractor operations and costs (for example, there have even been instances where occupational safety and health requirements prohibit manufacturing to Department of Defense specifications).

Life Cycle Costing

Logistic support analysis requirements included in many contracts provide the information required for effective life cycle costing (human resources and training requirements, support equipment requirements, spare parts requirements, etc.), but Government personnel rarely use the data effectively. Most Department of Defense contracting officers focus totally on acquisition cost and pay little attention to the concept of total life cycle costing.

Life cycle costs are inherently less certain than acquisition costs, and Government decisionmakers are less willing to assume the risk of relying on life-cycle projections. The Department has no adequate means to monitor and evaluate actual versus projected life cycle costs (and, hence, no means to gain additional confidence in evaluating contractors' projected life cycle costs).

Subcontractors and Suppliers

The Department of Defense procurement processes are focused on prime contractors, even though purchased materials and components supplied by subcontractors represent 50 to 85 percent of the total cost. The Department does not require or encourage vendors' participation in strategic planning decisions or design processes. In fact, requirements of the competition advocates for *free and open* price competition for subcontractors and suppliers have the effect of keeping the supplier base in constant turmoil and make it virtually impossible for defense contractors to build a stable base of reliable, high quality, cost-effective vendors. This is the opposite of the practice generally credited for the high quality of Japanese products.

Emphasis on price competition by the Congress and the Department of Defense effectively precludes the development of long-term relationships between prime contractors and suppliers and stimulates an adversarial relationship between them. The absence of long-term relationships does not permit extended, cooperative design, development, and manufacturing exchanges between the primes and suppliers. Little or no emphasis is placed on value analysis or value engineering by suppliers or their primes.

Annual price competitions are weakened by the refusal of many of the best-qualified suppliers to participate due to their reluctance to become involved in complex, expensive, and non-productive Government rules and regulations. Many desirable, highly-qualified suppliers refuse to do business with defense prime contractors because of the sheer weight of compliance with the body of laws, regulations, rules, and procedures that primes are required to pass through from the Government to them. This narrows the range of potential suppliers and reduces competition.

From the prime contractors' point of view, the flow-down requirements for subcontracts are virtually impossible to administer on the limited margin allowed by the Department of Defense. Small and disadvantaged business set-aside requirements imposed on defense prime contractors (together with excessive requirements for record-keeping and reporting and multiple, uncoordinated compliance reviews) further increase the administrative costs of doing business with the Department of Defense and may result in the lower quality and/or higher cost of purchased components.

Contract Administration

Multiple layers and large numbers of Government overseers, inspectors, and auditors (Army/Navy/Air Force plant representative offices, the Defense Contract Administration Service, administrative contracting offices, the Defense Contract Audit Agency, etc.), many of whom are resident in contractors' facilities, add significantly to the costs of doing business with the Department of Defense.

One result of the Government's heavy emphasis on oversight activities is that management focuses its attention more on passing audits and inspections than on improving quality and productivity. Many defense contractors believe that the Government's practice of imposing layer-upon-layer of quality inspectors and after-the-fact quality controls actually inhibits the development of modern systems such as statistical process control and other effective quality systems.

Management Issues

For firms in the defense industrial base, factors other than engineering excellence, innovation, and product quality often determine success or failure. These include their political constituency and the effectiveness of Washington lobbying efforts (both of which tend to restrict competition). Even management skills must be different. The need to have detailed knowledge of the *ins and outs* of the procurement process, the patience to deal with the process, and large and capable staffs of *documenters* to comply with reporting/compliance requirements imposed by the Department of Defense and Congress all are skills virtually unknown outside defense business.

For defense contractors, as compared with commercial manufacturers, management has a much smaller impact because of the degree to which contractors' operations are controlled and limited by the Department and the Congress. Micromanagement of defense programs and budgets and of contractor operations, a strong tendency to legislate broad remedies in response to isolated *horror stories*, and continuing use of defense procurements as instruments of social policy all are examples of Departmental and congressional activities that significantly add to the Department's costs and impede efficient, professional procurement efforts.

Many defense contractors feel that modern manufacturing management techniques (just-in-time inventory control, statistical process control, etc.) do not apply to them because of limitations imposed by Department of Defense rules, regulations and practices. For example, a large bureaucracy dedicated to *inspecting in* quality severely restricts contractors' incentives and ability to apply statistical process controls to *build in* quality.

It is difficult, to use another example, for a defense contractor to establish a research and development strategy, and difficult to measure its effectiveness. Research and development productivity in the private sector is controlled by strategic planning, resource allocation, and corporate culture. In defense industry, contractors have little control over the first two factors (which are largely controlled by Government budget decisions and regulations).

Emphasis on meeting specifications also reduces incentives for quality and innovation. Non-defense companies tend to be more efficient and innovative, not because their people are better, but because they are free of the restrictions imposed by the Congress and the Department of Defense.

CHAPTER V

BOLSTERING INDUSTRIAL COMPETITIVENESS

The several hundreds of Government and private sector experts who contributed to this effort were extremely forthright -- frequently even harsh -- in their assessments of the problems in our manufacturing base attributable to private sector managers, Government policies, and most notably, Department of Defense policies and practices. We seriously have evaluated their contributions and have attempted to report those assessments faithfully and act upon them effectively.

Over the course of this effort, we determined that a significant number of required improvements are possible within the existing authority of the Department. In fact, we identified numerous ongoing Departmental programs and recent initiatives to improve manufacturing operations in the defense industrial base. These include a number of actions that relate directly to the conclusions and recommendations of this report.

There are other recommended actions that primarily are directed to the Department of Defense, but will require coordination with the Congress and other departments and agencies of the Executive Branch. Finally, there are recommendations for action by the Government that clearly are beyond the scope of Department of Defense responsibility and authority. For these, the Department of Defense urges prompt consideration by the appropriate authorities.

CONCLUSIONS AND RECOMMENDATIONS

The remaining portion of this section contains 19 conclusions and recommendations for action by the Department of Defense and other Government departments and agencies. The order of presentation generally corresponds with our six major thrusts: (1) forging the right relations with industry; (2) improving the acquisition system; (3) establishing defense industrial strategic plans that support our military strategic plans; (4) developing manufacturing capabilities concurrent with the development of weapon systems; (5) laying the foundation now for the technical skill base required for tomorrow's defense needs ; and (6) ensuring that

industrial base issues important to our defense benefit from the full spectrum of potential policy remedies, when appropriate.

Forging the Right Relations With Industry

Conclusion

The Department of Defense ability to meet the materiel needs of our security objectives relies on the private sector and is being impeded by an exaggerated adversarial relationship. Lack of trust on both sides, perhaps fully justified, creates an environment in which significant improvements are increasingly difficult.

Discussion

Regardless of the source of distrust, there is a powerful need to build a cooperative relationship between the Department of Defense and industry that will lower barriers to improvements, enable more effective policy development and implementation, and contribute to the national goal of a strong industrial base.

This could be accomplished by creating a mechanism that would contribute to better understanding and consistency of effort by enabling senior industry managers (while avoiding any possible conflict of interest) to participate in the analysis of priority issues and alternative solutions.

Two bodies, a Manufacturing Advisory Council and a Defense Manufacturing Board might function in similar ways, but in different environments. The Manufacturing Advisory Council's activities would be focused on public policy issues and national economic issues relating to manufacturing, and would provide the Department an essential linkage to civilian issues, programs, and policy options in these areas.

The Defense Manufacturing Board would be established within the Department as a permanent entity, with a permanently assigned secretariat, or staff. Its functions would be keyed directly to defense manufacturing issues and problems. A key function would be to provide visibility to manufacturing and industrial base issues within the Department of Defense.

Recommendation

The Department of Defense should immediately begin to establish a non-adversarial means of communication between industry and the senior policymakers of the Department. Potential means to this end include establishment of:

- a. A Manufacturing Advisory Council, sponsored by the National Academy of Sciences, an objective third party, and;
- b. A Defense Manufacturing Board, an internal organization (modeled, perhaps, after the Defense Science Board).

Strategic Planning Task Force

Conclusion

The implicit strategy of the Department of Defense for addressing industrial base issues has been to conduct ad hoc studies of current problems. While individually important and useful, they have not been sufficient to resolve problems stemming from occasionally conflicting regulations, laws and directives, and inconsistent attention and resources dedicated to industrial base issues. The result has been insufficient resource allocations, confusion and lack of effectiveness in solving industrial base problems.

Discussion

A coherent, effective organization is required now to coordinate and provide oversight of ongoing industrial base initiatives and, more importantly, to do the necessary planning and organization work required to establish permanent institutional mechanisms.

Recommendation

The Department of Defense should ensure a viable industrial infrastructure is maintained to provide military materiel in the quantity and quality required during peacetime and for emergencies. Specifically, the Department should develop industrial strategic plans explicitly linked to military operational plans. The goal should be to identify and address actual and potential shortfalls systematically through mechanisms that sort out the relative urgency and importance of technological and industrial requirements against a backdrop of military planning scenarios and objectives. The Department should provide for a continuing assessment of both the short and long-term defense industrial base capabilities along with a clear enunciation to industry of what is needed from the industrial base and when.

The Department of Defense should immediately establish a task force under the direction of the Under Secretary of Defense (Acquisition), staffed with specialists from the Office of the Secretary of Defense, the Military Departments, and the Organization of the

Joint Chiefs of Staff, to expedite implementation throughout the Department of these and other actions identified in the report. Among other things, the task force should:

- 1. Develop and staff a Departmental policy statement regarding defense industrial strategic planning in support of military operational plans.**
- 2. Determine the organizational structure, staffing and budget necessary to institutionalize the defense industrial strategic planning function in support of military operational plans.**
- 3. Establish senior level liaison with selected allies, American industry, and appropriate civil agencies such as the Departments of Treasury, State and Commerce.**

Production Base Advocate

Conclusion

The system that has been erected over decades by both the Department of Defense and the Congress to obtain the materiel necessary for our security could be improved to accomplish more effectively the objectives of providing the military with appropriate technologies, within reasonable time periods, at reasonable cost, and of yielding outstanding quality products that can be produced in time and in the necessary quantities to satisfy potential emergencies.

Discussion

The laws and regulations under which Defense acquisition programs function are, by any measure, a *hodge-podge* which has evolved over several decades. A substantial portion of the entire body of rules was put in place in response to specific occurrences of poor management or wrong doing, and is intended solely to ensure that these occurrences *can never happen again*. Typically, such remedial actions initially were not evaluated for soundness and feasibility of implementation, nor have they been subsequently evaluated. There is a compelling need for institutional means, such as a Production Base Advocate, to test objectively the soundness and impact on industrial efficiency of existing and proposed laws and regulations, as well as the means to develop and test innovative alternatives to such laws and regulations.

Key characteristics of the office of Production Base Advocate should include:

- A small, but highly qualified staff, headed by the Department's Production Base Advocate. Other staff members would be drawn from the Military Departments and Defense Agencies, in the same manner as for other joint program offices;
- Annual budget authority to support tests of innovative manufacturing and industrial base programs;
- A board of advisors, with membership from industry, academia, and other Government organizations (the Manufacturing Advisory Council and/or the Defense Manufacturing Board could fulfill this function).

The Production Base Advocate should have broad authority to deviate from acquisition regulations (both legislative and administrative based) in the process of conducting experimental programs to improve Department of Defense management.

Recommendation

The Department of Defense should establish an office of Production Base Advocate, an institutional structure to receive, evaluate, and test innovative ideas for improvement of Department of Defense manufacturing programs.

Analytic Capability to Develop Defense Perspectives

Conclusion

The Department of Defense has not had adequate institutional mechanisms for maintaining awareness of either technology or industry trends, nor for understanding, analyzing, or assessing the national and international issues that surround the questions of American technological or industrial competitiveness.

Discussion

In order to guide defense policy more effectively, the Secretary of Defense and the Under Secretary of Defense (Acquisition) require coherent, dedicated data acquisition and analysis support not currently available to them. In developing this capability, the Department should recognize existing programs which might be adapted to address this shortfall. Two such programs, the Defense Industrial Network and Project SOCRATES, that are now in their formative stages, are being established to deal with specific problem areas in manufacturing and technology, but might economically be adapted to fill this need.

Recommendation

The Department of Defense should establish permanent, institutional mechanisms to acquire, analyze, and assess manufacturing and technology data and provide the principal officers of the Department cogent, objective advice with respect to defense issues that involve the performance of the United States industrial base. The Defense Industrial Network and the Defense Intelligence Agency's Project SOCRATES should be merged and adapted to fill this requirement for data.

Foreign Dependencies

Conclusion

From the national security perspective, foreign dependencies in technologies essential to defense production are inherently risky, and minimizing them should be a Department of Defense and national priority. However, there is at present no reliable system even to identify such dependencies, not to mention systems to minimize them. Especially in critical lower-tier industries which support defense prime contractors, visibility is key to maintaining the ability to assess the consequences of foreign-sourcing and evaluate the implications of the potential loss of leadership in key technologies.

Discussion

The Department of Defense does not know the extent to which foreign-sourced parts and components are incorporated in the systems it acquires. There is no systematic, established means to identify foreign-sourced parts and components and, hence, no way to determine the extent of foreign dependencies or vulnerabilities. There have been a number of *ad hoc* efforts that have identified specific foreign dependencies and preliminary indications that foreign dependencies are increasing. In a national emergency, the consequences of extensive dependence on foreign sources could be extreme.

More immediately, however, an apparent consequence is that we are experiencing the loss of technological leadership in key manufacturing technologies at an increasing rate. This has extremely adverse potential for our long-term security interests.

Recommendation

The Department of Defense should develop and implement systems to provide visibility of critical foreign-sourced items in or proposed to be in new weapon systems, prior to the demonstration/validation decision milestone during the acquisition decision making process.

Factory Modernization Investments

Conclusion

Defense acquisition programs are not conducted in a normal market environment, and the absence of normal market incentives is a barrier to contractor investment. In the absence of normal market incentives, the Department of Defense has developed alternative programs, primarily a rigid set of procurement rules and regulations. There are aspects of these Departmental procurement policies and regulations that impede investments for increased productivity. The Department's Industrial Modernization Incentives Program, designed to stimulate contractor investments, must be administered within this contrary environment and, therefore, is not as effective as it otherwise might be.

Discussion

Some Department of Defense policy-related impediments to investment have existed for many years. Among these are:

- Cost-based production contracts, which not only fail to reward contractors for reducing costs, but often actually penalize reduced costs by also reducing profits. In effect, the most efficient contractor earns the least profit and, conversely, the least efficient earns the most;
- Emphasis on low acquisition cost and schedule compliance, to the virtual exclusion of low life cycle costs and producibility and reliability considerations.

Others of more recent origin pose even greater threats to the long-term efficiency and productivity of the defense industrial base:

- Increased emphasis on price competition, which forces short-cuts and reduces incentives for investments in new equipment and quality systems;
- Intense pressure on profits -- down to levels that virtually guarantee contractors will have limited ability to invest in future productivity programs or high-quality people;

- **The absence of risk-sharing for innovation;**
- **Emphasis on forcing contractors to fund (and assume risk for) program-specific tooling and test equipment.**

In the short-term, such policies and practices may result in reduced program acquisition costs, which is their intent, but in the long-term, they may be counterproductive if they accelerate the decline of the defense industrial base.

Recommendation

The Department of Defense should assign high priority to resolving the issues of incentives for productivity enhancing investments by defense contractors and to creating an environment more conducive to successful administration of the Industrial Modernization Incentives Program. This task will require detailed analysis of the effects of virtually every aspect of defense acquisition policy, much of which is mandated in law. This substantial undertaking may be an appropriate high priority task for the Production Base Advocate, assisted as required by the Manufacturing Advisory Council and the Defense Manufacturing Board.

Program Stability

Conclusion

There is little doubt that program and process instability and uncertainty are extremely detrimental to defense acquisition and manufacturing management. Much of the instability and uncertainty clearly is attributable to lengthy budget and program decision processes within the Executive Branch. Equally clear, much of it is attributable to congressional micromanagement, not just of defense programs, but of small details of the acquisition management process. It is unlikely that major improvements in defense acquisition and manufacturing management will be achieved in the absence of greater predictability, stability, and certainty in programs and the acquisition process.

Discussion

Both Congress and the Department of Defense contribute to an environment which is inimical to good manufacturing practices and cost containment, and which is a strong impediment to investment by defense contractors. Elements of the environment include constant budget turbulence, small-volume programs, year-to-year program uncertainties, program *stretch outs*, changes in the rules of contracting (competition, military requirements, allowable profits, audit standards, etc.), late appropriations, and uncertain congressional continuing resolutions. These great uncertainties by themselves are sufficient to motivate defense contractors not to invest in productivity improvements. They also serve as strong impediments to highly qualified commercial manufacturing firms entering the defense market; and in some cases, they have been primary causes of firms leaving the defense market.

Recommendation

The Department of Defense must support and make better and more extensive use of programs already available (or potentially available) to stabilize major acquisition programs. These include two-year budget cycles, multi-year contracts, and a more realistic (achievable) five-year program. There also must be incisive analyses of programmed and budgeted development and production rates specifically focused on the issues of manufacturing efficiency and cost, contractor incentives for investment, and long-term impact on industrial capacity and capability.

Life Cycle Costs

Conclusion

The most effective measure of the value of a weapon system is based not on its initial acquisition cost, but on the total costs over its entire fielded life. Effective, universal use of true life cycle costing techniques is an imperative if the Department of Defense is to acquire the most effective and reliable systems at affordable overall costs.

Discussion

The concept of life cycle costing provides the most sound basis for effective evaluation of proposed weapon system research and development and production programs. However, life cycle costing is not often used effectively in the evaluation and source selection processes. Program managers and source selection teams often focus overwhelmingly on up-front costs and schedule considerations in evaluating proposals. Budget pressures are an obvious cause of these priorities, but there are other, perhaps equally important, causes.

Department of Defense personnel are uncomfortable with the inherently uncertain down-stream costs implied in the issues of how reliable a system is and how easily it can be maintained and used, as they are reflected in contractors' projections of requirements for human resources and training, support equipment, spare parts, etc. Even after the fact, the Department has no adequate means to monitor and evaluate actual versus projected life cycle costs and, hence, has no means to gain added confidence in future evaluations of contractors' projections of life cycle costs. One consequence is that the Department of Defense rarely assigns any weight to contractors' reputations for producing reliable, high-quality, low-maintenance systems, because it has little ability to do so.

Recommendation

The Department of Defense should raise the priority of using life cycle costs as a basic evaluation technique in acquisition programs. An assessment should be made of the progress of the Department of Defense in applying this concept. More research should be conducted to achieve a better understanding of the concept and how it can be exploited for the Department's benefit. Specific procurement experiments should be conducted to explore how the use of life cycle costing can be developed to reduce overall costs of weapon systems.

Quality Control

Conclusion

Current Defense Department acquisition management systems and procedures do not adequately recognize the importance of effective quality control programs in contractors' plants nor do they provide sufficient incentives for contractors to invest in such programs.

Discussion

In other countries, most notably Japan, techniques and processes for achieving consistently high quality manufactured products have progressed much more rapidly and have been more widely adopted than in the United States. Within the United States industrial base, firms in the defense sector have lagged even further behind. To some extent, Department of Defense acquisition and management practices are causes of the reluctance of defense contractors to adopt advanced quality control programs. Department of Defense practices, which have been characterized as *inspecting quality in*, do not recognize or adequately reward contractors who achieve effective quality control and, hence, provide little incentive for them to do so.

Recommendation

The Department of Defense should develop an effective *quality first* program, and dedicate the resources required to implement such an effort. An effective program will require, among other things, basic changes in emphasis in source selection criteria and procedures and extensive training of Department of Defense personnel in modern quality control systems and processes.

Commercial Specifications and Processes

Conclusion

Department of Defense programs might benefit greatly from increased use of commercial specifications and, especially in the lower tiers, from increased use of the same resources (design, engineering, production facilities) to manufacture both military and commercial products. Potential benefits include reduced lead times, reduced costs, improved quality and reliability, and increased responsiveness to meet surge and mobilization requirements.

Discussion

The separation in the industrial base between defense and commercial production is nearly absolute. There are few examples of firms that produce both military and commercial products in the same plants. There are firms that serve both markets, but they invariably maintain rigid separation between the two lines of business. These firms, however, do have a more informed view of the difficulties involved in attempting to integrate production of military and commercial products. Their perceptions are that barriers to integration range from the immense burdens imposed on defense contractors by Government rules and regulations (including, for example, cost accounting standards which require defense contractors to keep two sets of books) to the unique requirements of thousands of detailed process and product specifications (which frequently are obsolete by the time they are promulgated). In many product and process technologies, commercial practice has surpassed defense practice, with the result that the Department of Defense often pays more for less advanced products.

Recommendation

The Department of Defense should vigorously pursue efforts to increase use of commercial manufacturing process and product specifications, in lieu of unique military specifications. The Department also should comprehensively identify barriers to integrated manufacturing of commercial and military products and examine alternative practices which might facilitate such integration.

Emphasis on Process Technology

Conclusion

American manufacturers, in many cases, are unable to get products from research and development into the market as fast as is necessary to be competitive. There are many examples where American manufacturers are unable to develop and apply new process technology in their operations as fast as their international competitors. In the defense sector, the Department of Defense Manufacturing Technology Program is the only existing program focused specifically on development of advanced manufacturing process technology.

Discussion

The Department of Defense Manufacturing Technology Program has contributed greatly to the advancement of generic manufacturing science and technology, but even more productive results could be achieved with greatly expanded and more predictable levels of resources. The Department of Defense also must find specific means to integrate concurrent product and process technology development into research and development programs and the acquisition life cycle. One way would be to require concurrent development of efficient, cost effective manufacturing capability as part of all research and development efforts. Among the measures that could be pursued is a contract clause tailored to each research and development effort to require development and demonstration of the ability to produce the product.

Recommendation

The Department of Defense should develop a comprehensive program to ensure development and application of effective, advanced process technologies concurrent with basic science and technology programs and weapon systems development programs. The program should have four major thrusts: (1) development of manufacturing technology as part of all basic science and technology programs; (2) development of manufacturing technology in all weapon systems development programs; (3) changes in policies governing contractor independent research and development/bid and proposal costs to stimulate emphasis on manufacturing technology and, (4) greatly expanded emphasis and resources for the Manufacturing Technology Program.

Technological Skill Base

Conclusion

The quality of the nation's technological skill base is an indicator of the future prospects for American industrial competitiveness. The source of the technical skill base is our university system. While the quality of the system is sound (and it remains a national competitive advantage when compared to the rest of the world), there are some areas of concern.

Discussion

Much of the discussion about technical education focuses on funding, but the issue is equally one of national leadership. The nation must build its technological skill base if it is to achieve the goals of security and well being of its citizens. Current data suggests that foreigners may be utilizing our graduate technical programs more than we are (85 percent of the recent growth in graduate education has been from foreign students often on state subsidy and/or Federal Government grants). Coupled with demographics that will reduce the pool of potential scientists and engineers, there is a growing problem that can be altered only by national leadership.

The effort should include all Federal agencies with technical missions, including the National Aeronautics and Space Administration, the Department of Energy, and the National Bureau of Standards of the Department of Commerce. National political and business leaders should be involved with a multi-media approach to achieve a national consensus for support. Industry should be stimulated to assist with the effort in local and regional programs, seminars, cooperative education efforts, and, particularly, with attractive technical career path opportunities.

Recommendation

The Department of Defense should lead the organization of a national program to stimulate enrollment in both undergraduate and graduate technical programs to assure both the quantity and quality of technically qualified graduates necessary for national success. A specific objective should be to raise the prestige and attractiveness of technical careers, with particular emphasis on manufacturing.

Incentives for Technical Education

Conclusion

The Department of Defense, perhaps more than any other agency, depends on technology as its lifeblood. The Department has a direct stake in the quantity and quality of science and engineering graduates. Efforts must be made to reverse the decline in numbers and capabilities of technically educated personnel.

Discussion

The Department of Defense might offer scholarships at schools willing to build world-class manufacturing engineering programs. Selection of the schools would be based upon:

- Industrial commitment to maintain leading edge university expertise;
- Industrially supported faculty positions to enable the world's best manufacturing managers to teach future generations;
- Industrial hiring programs to assure that the finest career opportunities are afforded the new generation manufacturing manager;
- State and university commitments for faculty and curriculum development to ensure America remains on the leading edge of the development and management of technological progress.

Recommendation

The Department of Defense should combine a scholarship program in manufacturing engineering with a plan to build university expertise in manufacturing. The program should be developed jointly with industry.

Educational Facilities

Conclusion

State-of-the-art education facilities represent another deficiency in American universities for teaching manufacturing-related science and engineering skills and, hence, provide another impediment for students and faculty alike to pursue manufacturing careers.

Discussion

An instrumented factory program might competitively award grants for a number of advanced manufacturing technology demonstration centers to universities or non-profit coalitions of manufacturers, equipment suppliers, material suppliers, and other appropriate organizations. Each center would consist of an instrumented factory that produces limited quantities of military items, using the latest available state-of-the-art manufacturing technologies. The program would provide for conducting Government-funded research and development associated with the processes used in the factory, encompassing the physical, data, control, and human factors. Mechanisms would be required to ensure that the technologies are promptly implemented in private companies.

Recommendation

The Department of Defense could provide seed money for an instrumented factory program for industries where there are large numbers of companies and significant non-defense applications.

Production Base Impact Assessment

Conclusion

There is a need for focused, coherent analysis of issues affecting American manufacturing industries.

Discussion

United States law and policy historically have been developed primarily in response to domestic requirements, with little attention given to the possible harmful effects they may have on the health, vitality, and long-term survival of American manufacturing industries in an increasingly competitive international environment. Explicit assessments of the effects of legislation and regulation on the health and vitality of our production base should be conducted prior to their promulgation.

Recommendation

The Department of Defense recommends establishing a substantial analytic capability within the Legislative Branch dedicated exclusively to objective analysis of the impact of existing and proposed legislation on the United States manufacturing base and its ability to compete internationally.

Coherent Tax Policies

Conclusion

Direct, indirect, and hidden taxes on the United States manufacturing base are, by current world standards, not conducive to investing at the required levels to achieve and sustain world leadership in advanced technologies and manufacturing processes.

Discussion

Efforts to achieve equitable tax policies domestically have resulted in a substantial shifting of tax burdens from individuals to industry. Especially troublesome to many American manufacturing firms is the fact that the tax burden on industry is fully reflected in the costs of domestically manufactured products, but not in the costs of foreign-manufactured products sold in the American market, even though alternative tax structures to equalize the tax burden across all products are permitted under the General Agreement on Tariffs and Trade.

Recommendation

The Department of Defense advocates and supports the concept that there should be a comprehensive analysis of tax policies specifically focused on enhancing the international competitiveness of American manufacturing industries. The Department of Defense recommends that the President and the Congress jointly cause this comprehensive analysis to be undertaken as a national priority.

Coherent Trade and Domestic Policies

Conclusion

Many other elements of Federal law (antitrust, environment, safety, etc.), other than the tax code, also affect the operations and costs of manufacturing in the United States. In many cases, such laws are unique to the United States and, therefore, represent unique financial burdens on domestic manufacturers.

Discussion

Trade policies, as well as elements of domestic policies (antitrust, etc.) are significant determinants not only of the level of resources that are or can be devoted to defense, but of the productivity of the industries supporting our defense. From the perspective of security policy, the Department of Defense believes that in formulating trade policies, within the framework of international agreements, attention should be focused on the impact such policies have on American competitiveness and stimulating a productive manufacturing base. Domestic policies also should be examined from this perspective.

Recommendation

The Department of Defense advocates and supports the concept that there should be a comprehensive analysis of trade policy and domestic policies, specifically focused on enhancing the international competitiveness of American manufacturing industries. The Department of Defense recommends that the President cause such fundamental examinations to be undertaken as national priorities.

Education and Training

Conclusion

There is substantial evidence that the basic skill levels of many American high school graduates are not adequate for the needs of manufacturing firms. At the university level, curricula does not adequately focus on manufacturing processes, technologies, or management. Continuing education programs for professionals and workers alike are inadequate or nonexistent in most American firms.

Discussion

The Department of Defense is dependent upon a continuing flow of highly qualified mathematicians, scientists, engineers, and technicians, as well as an adequate supply of skilled, motivated line workers in manufacturing processes and maintenance programs. Shortages in these areas create market distortions, which disrupt development and production schedules, reduce quality, and increase costs. Education and training are the most fundamental long-term national priorities in the effort to sustain an advanced industrial economy and to provide adequately for our defense.

The Department of Defense traditionally has been and continues to be involved in scientific and technical educational programs, but has not recently subjected its educational programs to rigorous review from the perspective of modern industrial requirements. There also has been no recent fundamental examination of the quality or relevance of American educational systems (at all levels) specifically from the perspective of the needs of an advanced industrial economy. The combination of deficiencies in education and training at all levels represents, perhaps, the most serious long-term problem facing the United States industrial base.

Recommendation

The Department of Defense problem with respect to inadequate skill levels in the United States is a component part of the national problem. The Department recognizes that long-term basic solutions are beyond the scope of its responsibilities and capabilities and urges that there be a national effort, beginning now, to achieve these long-term solutions.

Private Sector Issues

Conclusion

Notwithstanding the continuing successes of some entire sectors of the United States manufacturing base and of individual firms in other sectors, there is a pervasive problem with the quality and effectiveness of management in American manufacturing industries.

Discussion

The findings of this study are, collectively, an indictment of management in American manufacturing firms. This is a particularly sensitive problem because Government has little or no ability to address the problem or to contribute to its solution. Of course, one exception is that Government should ensure that its current practices that are intrusions into the operations of manufacturing firms do in fact impose the least possible harm on these firms. However, this should not be construed to mean Government will shirk its oversight responsibilities. A less obvious exception lies in the potential for Government to influence the expectations and actions of owners and managers through, for example, changes to tax law to discourage an excessive focus on the short-term and to provide incentives for long-term investment in technology development and implementation.

Recommendation

The Department of Defense can contribute substantially to improved management in defense firms through improved acquisition processes, selective contract incentives based on competitive cost reductions, and a concomitant effort to reduce its intrusions into management's affairs. The management problem in non-defense industries, however, is largely beyond the reach of Government agencies. At a minimum, however, unnecessary Government barriers to management motivation to achieve manufacturing excellence and competitiveness must be identified and dismantled.

POST SCRIPT

**by Dr. Robert B. Costello
Under Secretary of Defense (Acquisition)**

The research that formed the basis for the recommendations contained in this report was conducted over more than a year's time. As good ideas came to the fore during this period, we chose to act upon them rather than await final publication of the report on this initiative. Some of the recommendations already are ongoing within the Department. For example, one key recommendation in this report, perhaps the highest priority, is directed to forging better relations with industry. Proper cooperation between industry and Government is essential for creating a *win-win* situation for both parties and for ensuring the existence of a healthy and vital industrial base from which the Department can draw its mission requirements.

To this end, the establishment of a Defense Manufacturing Board within the Department of Defense is underway. This new Board has an approved charter, and the nomination process for members has begun. The National Academy of Sciences has agreed informally to create a Defense Manufacturing Strategy Committee, referred to in the report as the Manufacturing Advisory Council. Nominees to this Committee also have been identified. The Defense Science Board has formed a Defense Industrial and Technology Base Task Force. This Task Force will examine in greater detail the recommendations we have made on bolstering defense industrial competitiveness. These beginning efforts should provide the foundation for a more effective partnership between the Department and the industries upon which we rely and for developing innovative solutions to both the short- and long-term problems identified in the report.

Two key actions required to ensure a comprehensive, sustained effort to implement these and other new initiatives are: (1) to provide a senior-level focal point to concentrate Departmental responsibilities for industrial base programs; and (2) to acquire the factual data required to support sound industrial base plans and programs.

Efforts are actively underway to establish the new position of Deputy Under Secretary of Defense (Production Base and International Technology), who was referred to in the report as the Department of Defense Production Base Advocate. Along with its institutional responsibilities to receive, evaluate, and test innovative ideas to improve Department of

Defense manufacturing programs, the Office of the Deputy Under Secretary of Defense (Production Base and International Technology) will serve as the focal point within the Office of the Secretary of Defense to oversee and coordinate all manufacturing-related activities of the Department.

The Office of the Deputy Under Secretary of Defense (Production Base and International Technology) also will be responsible for acquiring, organizing, maintaining, and disseminating data required for defense industrial base plans and programs. This effort already has begun with the staffing of a directive merging the Defense Industrial Network and Project SOCRATES into the Defense Industrial Base Information Administration. This effort will be broadened in the near future to develop means to identify critical foreign-sourced items in current and proposed weapon systems programs.

With these two key actions underway, the foundations are being laid for establishing the comprehensive, dedicated capabilities we require to manage effectively a great many discrete industrial base programs. Many of these already are underway and will continue, but they will be placed under the general cognizance of the Deputy Under Secretary of Defense (Production Base and International Technology) for oversight, policy guidance, and Department-level management.

Educational initiatives are, in the long-term, perhaps the most significant of the recommendations contained in the report. We intend to move resolutely, but cautiously, on these: resolutely because the issue of superior technical and scientific education is critical to the nation's future; cautiously because the Department of Defense properly is limited to a support role in this issue, which involves every level of Government.

A number of the remaining recommendations relate to efforts already in place within the Department or to recent new initiatives. This, of course, does not mean that we have solved all our problems. These are partial solutions to very complex problems that will continue to require our attention and the best ideas from industry, Government, and our allies.

For example, in order to help ensure that sectors critical to our security, such as the semiconductor and machine tool industries, become more internationally competitive in manufacturing technology, the Department has provided support for the establishment of a

Semiconductor Manufacturing Technology Consortium and a National Center For Manufacturing Science.

Our Total Quality Management effort is another example of a current effort underway within the Department that is in consonance with the findings of this study. We are working to broaden the focus of quality to change the present culture of the acquisition process, contractual requirements, design and manufacturing practices, and the modern concept of quality. We hope to provide the means to change the quality culture across the Department of Defense and industry by reducing weapon systems' costs while improving their quality in the field.

We are now in the process of forming a strategic planning task force, with membership from the Office of the Secretary of Defense, the Military Departments, the Organization of the Joint Chiefs of Staff, and the Defense Logistics Agency. The principal purpose of the task force will be to establish meaningful linkages between the materiel requirements of military operational plans and the industrial base and technology programs managed by the Deputy Under Secretary of Defense (Production Base and International Technology). A substantial portion of this task already has been accomplished and provides a solid foundation for the work of the task force. The Joint Industrial Mobilization Planning Process is the analytic and assessment process used by the Military Departments, Organization of the Joint Chiefs of Staff, and Defense Agencies to perform industrial capabilities analyses for the Joint Strategic Planning System and to link industrial mobilization plans to operational plans.

Substantial progress also has been made on the recommendations for: improving incentives for producibility enhancing investments; focusing the acquisition system on life cycle costs; increasing use of commercial product and process specifications; and greatly increasing our emphasis on the development of advanced manufacturing technology.

Contact also has been made with the Economic Policy Council in the Executive Office of the President in order to begin establishing a means of exploring further the national policy issues discussed in this report.

Many other efforts are being pursued within the Department of Defense. These, in conjunction with the new ideas emanating from this study, have formed the basis for implementing this action plan to bolster defense industrial competitiveness.